

San Luis Obispo County Integrated Proposal Flood Damage Reduction Costs and Benefits

Project Number 3. Zone 1/1A Waterway Management Program, 1st Year Vegetation and Sediment Management Project will provide increased flood conveyance capacity in the lower Arroyo Grande Creek channel. This attachment will provide estimates for the flood damage reduction benefits which include:

- Avoided physical damage to:
 - Buildings
 - Infrastructure
 - Crops
 - Ecosystems
- Avoided emergency response costs
- Avoided public safety and health impacts

Table 9-1 summarizes the monetized costs and flood damage reduction benefits for the Zone 1/1A Water Management Program, 1st Year Vegetation and Sediment Management project. The documentation for these cost and benefit estimates is provided in the following sections.

**Table 9-1 Monetized Flood Damage Reduction Benefits of the
Zone 1/1A WMP, 1st Year Vegetation and Sediment Management Project**

	Requested Grant Funding	Total Project Costs	Total Project Benefits	Benefit / Cost
	\$	Present Value		Ratio
Project Number 3 Flood Control Zone 1/1A Flood Management Program	\$2,200,000	\$5,322,000	\$28,024,400	5.27

Introduction

The 1st Year Vegetation and Sediment Management Project will provide increased flood conveyance capacity in the lower Arroyo Grande Creek channel. Deferred maintenance due to increased sedimentation, stringent environmental protections, levee deterioration, escalating maintenance costs, and lack of funding have reduced the channel capacity such that levee overtopping can be expected with less than a 5-year storm event. When the Arroyo Grande levee system was breached on the south side, during a high rain event in 2001, hundreds of acres of farmland and several residences were flooded, resulting in damage claims to the County flood control district totaling over \$1,000,000. Impacts from the flooding persisted beyond the winter season as many of the areas with clay soils located in the southern portion of the valley remained saturated for many months.

The 1st Year Vegetation and Sediment Management Project contribute to the overall Proposal by addressing a high priority objective for the region – providing increased flood protection for the disadvantaged communities of Oceano and Cienega Valley farmland.

Project Costs

Table 9-2 summarizes all costs that will be incurred to implement and operate the project and to achieve benefits from the project. The capital and other initial costs for implementing the Zone 1/1A First Year Vegetation and Sediment Management is \$2,399,200 as documented in the table. The costs are based on the latest Project documentation and 30 percent design plans. The detailed cost estimate is included in Attachment 4, Budget, of this proposal.

Operation and Maintenance Costs

Operations and maintenance costs are estimated to be \$220,000, which includes \$80,000 for annual vegetation maintenance and \$140,000 for annual sediment removal. The District has been performing annual vegetation maintenance on the channel since 2006, with typical annual cost of \$80,000. The proposed sediment maintenance would be limited to “bar ripping” along the secondary channels. The yearly sediment maintenance cost were based on costs for similar activities on the San Lorenzo River in Santa Cruz, California, where sediment management has been successful in maintaining bed mobility while protecting habitat conditions and water quality. Costs associated with bar ripping along the San Lorenzo River were incorporated on a per linear foot basis to estimate the yearly sediment maintenance cost for the Arroyo Grande Creek Channel at \$140,000 (Exhibit 3A - S H+G, 2006, pg 39).

Period of Analysis

The period of analysis is through 2063, assuming a project life of 50 years starting after construction completion. Fifty years is the typical project life for structural water resource projects (Draft Economic Analysis Guidelines Flood Risk Management, DWR, May 2010, pg. 10). In addition, the original flood control project, as planned in 1959 (constructed in 1961), had a useful life of 50-years, which was acknowledged to be over since 2009.

The original project life of the Arroyo Grande Creek Flood Control Project was acknowledged to be 50-years by sponsoring organizations: Natural Resource Conservation District, San Luis Coastal Resource Conservation District and the San Luis Obispo County Flood Control and Water Conservation District. A 3-party agreement was executed on December 1, 2009, to acknowledge termination of the 1959 Operations and Maintenance Agreement for the original project, documenting mutual agreement between the parties that the existing project as planned in 1959 has reached its design life and achieved its intended purpose (Exhibit 3B - Acknowledgement of Termination of 1959 Agreement). The parties agreed that alterations to the original project’s purpose, design, and maintenance are necessary to accommodate changing regulations, watershed hydrology, and waterway management planning. The adopted Waterway Management Program is the product of the alterations determined necessary to the original project and thus, the completion of the proposed 1st Year Vegetation and Sediment Management Project, should be the beginning of the next 50-year project life.

Project Benefits

The flood damage reduction benefits of the 1st Year Vegetation and Sediment Management project include:

- Avoided physical damage to
 - Buildings
 - Infrastructure
 - Crops
 - Ecosystems
- Avoided emergency response costs
- Avoided public safety and health impacts

Flood damage reduction benefits for the 1st Year Vegetation and Sediment Management project were quantified in economic terms when related to avoided physical damage to buildings, infrastructure, and crops because this was easily quantified and calculated. There are several other project benefits of unknown quantities including avoided physical damage to ecosystems, avoided emergency response costs and avoided public safety and health impacts. A qualitative description of these other project benefits is provided as well.

Table 9-2: Annual Cost of Project (2009 dollars)

Project Phase	Year	Initial Costs	Operations and Maintenance Costs					Discounting Calculations		
		(a) Capital and Other Initial Costs from Table 7	(b) Admin	(c) Operation	(d) Maintenance	(e) Replacement	(f) Other	(g) Total Costs (a thru f)	(h) Discount Factor	(i) Discounted Costs (g) x (h)
Planning & Design	2009				\$0			\$0	1.000	\$0
	2010				\$0			\$0	0.943	\$0
Construction	2011	\$2,399,200			\$0			\$2,399,200	0.890	\$2,135,288
	2012				\$0			\$0	0.840	\$0
Project Life	2013		\$20,000		\$220,000			\$240,000	0.792	\$190,080
	2014		\$20,000		\$220,000			\$240,000	0.747	\$179,280
	2015		\$20,000		\$220,000			\$240,000	0.705	\$169,200
	2016		\$20,000		\$220,000			\$240,000	0.665	\$159,600
	2017		\$20,000		\$220,000			\$240,000	0.627	\$150,480
	2018		\$20,000		\$220,000			\$240,000	0.592	\$142,080
	2019		\$20,000		\$220,000			\$240,000	0.558	\$133,920
	2020		\$20,000		\$220,000			\$240,000	0.527	\$126,480
	2021		\$20,000		\$220,000			\$240,000	0.497	\$119,280
	2022		\$20,000		\$220,000			\$240,000	0.469	\$112,560
	2023		\$20,000		\$220,000			\$240,000	0.442	\$106,080
	2024		\$20,000		\$220,000			\$240,000	0.417	\$100,080
	2025		\$20,000		\$220,000			\$240,000	0.394	\$94,560
	2026		\$20,000		\$220,000			\$240,000	0.371	\$89,040
	2027		\$20,000		\$220,000			\$240,000	0.350	\$84,000
	2028		\$20,000		\$220,000			\$240,000	0.331	\$79,440
	2029		\$20,000		\$220,000			\$240,000	0.312	\$74,880
	2030		\$20,000		\$220,000			\$240,000	0.294	\$70,560
	2031		\$20,000		\$220,000			\$240,000	0.278	\$66,720
	2032		\$20,000		\$220,000			\$240,000	0.262	\$62,880
	2033		\$20,000		\$220,000			\$240,000	0.247	\$59,280
	2034		\$20,000		\$220,000			\$240,000	0.233	\$55,920
	2035		\$20,000		\$220,000			\$240,000	0.220	\$52,800
	2036		\$20,000		\$220,000			\$240,000	0.207	\$49,680

2037		\$20,000		\$220,000			\$240,000	0.196	\$47,040
2038		\$20,000		\$220,000			\$240,000	0.185	\$44,400
2039		\$20,000		\$220,000			\$240,000	0.174	\$41,760
2040		\$20,000		\$220,000			\$240,000	0.164	\$39,360
2041		\$20,000		\$220,000			\$240,000	0.155	\$37,200
2042		\$20,000		\$220,000			\$240,000	0.146	\$35,040
2043		\$20,000		\$220,000			\$240,000	0.138	\$33,120
2044		\$20,000		\$220,000			\$240,000	0.130	\$31,200
2045		\$20,000		\$220,000			\$240,000	0.123	\$29,520
2046		\$20,000		\$220,000			\$240,000	0.116	\$27,840
2047		\$20,000		\$220,000			\$240,000	0.109	\$26,160
2048		\$20,000		\$220,000			\$240,000	0.103	\$24,720
2049		\$20,000		\$220,000			\$240,000	0.097	\$23,280
2050		\$20,000		\$220,000			\$240,000	0.092	\$22,080
2051		\$20,000		\$220,000			\$240,000	0.087	\$20,880
2052		\$20,000		\$220,000			\$240,000	0.082	\$19,680
2053		\$20,000		\$220,000			\$240,000	0.077	\$18,480
2054		\$20,000		\$220,000			\$240,000	0.073	\$17,520
2055		\$20,000		\$220,000			\$240,000	0.069	\$16,560
2056		\$20,000		\$220,000			\$240,000	0.065	\$15,600
2057		\$20,000		\$220,000			\$240,000	0.061	\$14,640
2058		\$20,000		\$220,000			\$240,000	0.058	\$13,920
2059		\$20,000		\$220,000			\$240,000	0.055	\$13,200
2060		\$20,000		\$220,000			\$240,000	0.051	\$12,240
2061		\$20,000		\$220,000			\$240,000	0.048	\$11,520
2062		\$20,000		\$220,000			\$240,000	0.045	\$10,800
2063		\$20,000		\$220,000			\$240,000	0.043	\$10,320
Total Present Value of Discounted Costs [Sum of Column (i)]									\$5,322,248
(1) The period of analysis is through 2063, assuming a project life of 50 years. (2) Assume zero future construction cost inflation and escalation (3) Admin costs consist of Project Management (\$10,000), and annual survey of channel cross-sections (\$10,000); based on District project manager historical expenditure (100 hours staff time at \$100/hour) and consultant estimate for survey work. (4) Maintenance is the estimated cost to perform annual vegetation maintenance (\$80,000) and sediment removal (\$140,000) after construction based on consultant estimate and historical operations and maintenance costs.									

Flood damage reduction benefits for the 1st Year Vegetation and Sediment Management project were quantified in economic terms when related to avoided physical damage to buildings, infrastructure, and crops because this was easily quantified and calculated. There are several other project benefits of unknown quantities including avoided physical damage to ecosystems, avoided emergency response costs and avoided public safety and health impacts. A qualitative description of these other project benefits is provided as well.

Historical Flood Damage Data

On March 5, 2001, the most extensive flood damage occurred since the channel was constructed in 1961. Heavy rainfall of approximately 7 inches in February plus 4 inches on March 4 and early on March 5, with a season total of about 16 inches, caused the creek to rise above its banks as it flowed through Oceano. As it rushed to the ocean, it picked up all types of debris, including fallen trees. When it came to the flood control channel in Oceano, it passed the 22nd Street Bridge and Union Pacific Railroad Bridge with such force that the water plus the debris was enough to break an approximate 150 foot gap in the south levee, causing a devastating flood that inundated hundreds of acres of farmland adjacent to the creek.

By breaching downstream of the railroad tracks, on the south side in the lower reach of the flood control channel, flooding was largely confined to the westernmost agricultural land in the Cienega Valley (rather than all the agriculture land in the Proposition 218 Zone of Benefit). Fields were under 10 to 12 feet of water in some locations. The hardest hit area was Bejos Seeds Inc., a national distributor of vegetable produce seeds, which experienced approximately \$500,000 in losses due to the flood (Exhibit 3C - Story of the Arroyo Grande Creek, Robert Brown, pg. 30-31).

Immediately, work crews began repairing the levee in order to prepare for any potential storms in the 2001 rainy season. The total emergency watershed project cost was estimated at \$400,000 and included construction (\$188,000), design, environmental monitoring (\$133,000), and project management. The Natural Resources Conservation Service assisted with 75% funding (approximately \$300,000) to repair the levee through Cooperative Agreement No. 69-9104-1-197, Arroyo Grande Levee Repair Emergency Watershed Project (Exhibit 3D) and with engineering assistance provided by its Emergency Watershed Protection program. The U.S. Army Corp of Engineers also provided technical assistance on the repair.

The wastewater treatment plant, the airport, and most all of the residences and businesses are on the north side of the channel and thus, were unaffected by the 2001 flood. Ultimately, the 2001 flood led to 16 claims against San Luis Obispo County, resulting in a settlement of \$1,000,245, plus \$215,947 in attorney and mediation costs, for a total cost to tax payers of \$1,216,191.

“Without Project” Conditions

Without the 1st Year Vegetation and Sediment Management project, the existing flood flow capacity of the Arroyo Grande Creek channel will not be increased. As a result, overtopping of the existing levees would be expected with an approximate 4.6-year storm event causing flooding of agricultural lands south of the levee channel (Exhibit 3E - S H+G, 2006, pg 29). (North levee elevations are slightly higher, by design, to protect residential areas and direct overtopping to the south during the more frequent storm events such as the 2, 5, or 10-year events.)

A levee-topping event would inundate highly productive farm fields capable of 2 to 3 crops per year, with typical crops being Brussel sprouts, celery, cabbage, endive, lettuce, onions, peppers, spinach, squash, tomatoes, cherry tomatoes, and strawberries. Health and safety concerns related to leafy green crops have been in the forefront since E. coli contamination of spinach crops in San Juan Bautista in late 2006. FDA considers ready-to-eat crops (such as lettuce) that have been in contact with flood waters to be adulterated due to potential exposure to sewage, animal waste, heavy metals, pathogenic microorganisms, or other contaminants (FDA, 2005). Impacts from flooding could affect more than a single crop cycle, with clay soils remaining saturated and unworkable for many months. The Alternatives Study (S H+G, 2006) estimated that approximately 700 acres of cropland in Cienega Valley would be inundated with a levee overtopping during a 5-year storm event (Exhibit 3E - S H+G, 2006, pg 29).

During larger storms, 20-year event or greater, the flood damage would be greater including increased clean-up and crop-loss costs due to the increased flood volume and increased infrastructure and critical facilities damage that would be experienced during the worst-case scenario. The worst-case scenario during the 20-year event includes the south levee-topping event discussed above as well as failure of the north levee that would result in inundation of several residential developments and businesses, the Oceano Airport, and the regional Wastewater Treatment Plant that serves the communities of Arroyo Grande, Grover Beach and Oceano.

The worst case scenario that would occur during the 20-year event is the District's current maximum threshold for flood damages caused by a south levee-topping and/or north levee failure. Flood Control Zone 1/1A boundary was determined by the 20-year flood inundation area and is the zone of benefit for the special assessment tax revenues collected annually for operation and maintenance of the flood control channel and appurtenant structures.

Preliminary scheduling of the proposed 1st Year Vegetation and Sediment Management, within the constraints of current District assessment funding, proposes completion of the project in 2024. If grant funding is awarded, the proposed project, 1st Year Vegetation and Sediment Management, could be completed within 2 years increasing the channel capacity to contain the 8.3-year event and provide urgently needed flood protection. If not funded by this grant, construction of the project would be delayed at least 12 years (from 2012 to 2024), pending accumulation of recently approved Proposition 218 property tax assessments sufficient for construction costs. During that waiting period, the local community could only expect protection from less than a 5-year storm event.

With Project Condition

Project alternatives to increase the flood capacity of the Arroyo Grande Creek Channel includes: vegetation management, sediment management, and levee raising. Each alternative is incorporated as elements of the adopted Arroyo Grande Creek Channel Waterway Management Program and each provides incremental increases in channel capacity.

Grant money awarded would be used to implement 2 of the 3 program components, vegetation and sediment management. The 1st Year Vegetation and Sediment Management can be implemented as a stand alone project and, by itself, would successfully double the existing channel capacity (1,300 cfs, 2.8 year flood protection with 2-ft. freeboard, or 4.6 year flood protection with no freeboard) to provide 5-year flood protection with 2-ft. freeboard (2,500 cfs or 8.3 year flood protection with no freeboard). Award of this grant would advance the completion date of the project 12 years and would immediately benefit surrounding agricultural and residential areas, including the disadvantaged community of Oceano.

Early implementation of this project prior to the proposed levee raising is necessary in order to reduce implementation costs that would be realized when accommodating for "higher levees". If the levee(s) were raised first, access and work within the channel would be restricted by steeper side slopes and the ability of equipment to reach the channel bottom from the top of the levee(s). In addition, if the levee raising was completed first, the levee would likely need to be re-graded / repaired due to damages from heavy equipment access and the sediment removal work. Completing the 1st Year Vegetation and Sediment Management first is the most efficient way to begin increasing the channel capacity. Implementation of the 3rd program component, levee raising, would be completed at a later time when additional funding is secured.

With this project, flooding caused by overtopping of the levees would only be experienced during the larger, less frequent, 10-year or greater storm event. The worst case scenario of a south levee topping and north levee failure, as described in the previous section, would still occur during the 20-year event.

Completion of 1st Year Vegetation and Sediment Management project is the first and urgently needed step toward providing 20-year flood protection in the lower Arroyo Grande Creek Watershed that will be achieved with the combined projects of the WMP.

Benefits Analysis

Flood damage reduction benefits of the project were quantified when related to avoided physical damage to buildings, infrastructure, and crops. Other flood damage reduction benefits exist as well, but are qualitatively described in a subsequent section, “Other Flood Damage Reduction Benefits”.

In order to quantify the flood damage reduction benefits of the project, five flood events were selected for which flood conditions and associated flood damage will be different for without- and with-project conditions. The five flood events selected are the 2, 5, 8, 10, and 20-year. The method of measuring levels of protection for the existing channel was by the deterministic method and were evaluated using the existing conditions HEC-RAS model developed for the 2006 Alternatives Study (Exhibit 3F - SH+G, 15-16). It is expected that the project would improve conditions for the 5 and 8 year events.

Existing Conditions

For purposes of this flood damages reduction costs and benefits analysis, the following existing conditions were assumed.

During the **2-year event**, it was assumed that no damages would be experienced. The existing channel capacity is 1,300 cfs, or 2.8 year flood protection with 2-feet of freeboard.

Although no damages were assumed for purposes of this analysis, damages could be experienced with only a 2-foot freeboard to account for uncertainty in the modeled water surface elevation. A 3-foot freeboard is more often used for structural water resource projects (flood control projects) (Exhibit 3G - Draft Economic Analysis Guidelines Flood Risk Management, DWR, May 2010, pg. 38). In addition, the local condition is one in which dense vegetation and structures exists in and across the channel that can catch debris carried in storm flows, damming up water and creating higher water surface elevations and eddying at localized spots along the levee system that could lead to a levee-topping event prior to exceeding capacity (see photo to right).



In order to alleviate the residual flood risk, consequences of capacity exceedance or project failure prior to capacity exceedance, the District has developed the Arroyo Grande Creek Levee Failure Emergency Response Plan that is activated once the water surface in the channel reaches approximately the 2-year flood elevation. Avoided emergency response costs that would be experienced under the with-project condition will be discussed under “Other Flood Damage Reduction Benefits”.

During the **5-, 8- or 10-year event**, a levee-topping event would occur to the south inundating 700 acres of highly productive farm fields with typical crops being brussel sprouts, celery, cabbage, endive, lettuce, onions peppers, spinach, squash, tomatoes, cherry tomatoes and strawberries. Flood damage costs during the 5, 8 or 10-year levee-topping event would include compensation for crop-loss and farm field clean-up and repair.

It is expected that the project would improve conditions for the 5 and 8 year events. After construction of the project, the District would be confident that the channel would contain the 5-year flood flows since there would be a 2-foot of freeboard to account for any uncertainty as well as less vegetation in the channel to catch debris that could block flows. The District would only be 80% confident of the channel capacity during the 8-year event, as there is no available freeboard to account for uncertainty of the modeled water surface elevation. A 2-foot freeboard would be desired to account for uncertainty of the 8.3 year water surface elevation calculated in the hydraulic model. According to the model, the average water depth in the channel reach with the least capacity where an overtopping event would be most probable is approximately 10 feet. Assuming that 2-feet of freeboard (or 20% of water depth)

would provide the District with 100% confidence of passing the 8-year event, the no freeboard condition would reduce the District's confidence in passing the 8-year event to 80% correlating to an assumed risk of 20% probability of failure.

Flood damage reduction benefits for the levee-overtopping scenarios that would be experienced during a 2, 5, 8 or 10-year event were estimated as follows:

- The District estimated the annual crop revenue to be \$9,950 per acre, based on the 2009 harvested acreage and annual crop production reported by the San Luis Obispo County Agriculture Department (Exhibit 3H - 2009 San Luis Obispo County Crop Report).
- The District estimated the farm field repair and clean-up cost to be \$1,340 per acre based on the estimated cost to pump flood waters back into the channel after high flows recede, remove and dispose of debris, till and remove contaminated soils, conduct weed abatement by hand weeding and herbicide(s) application, perform required soils testing and mitigation for potential contamination from storm water pollutants.

A summary of the estimated repair and loss compensation per acre is provided in Table 9-3.

Item	Quantity	Unit	Est. Repair/Loss Compensation	Total Damage
Crop Loss	700	Acre	\$9,950	\$6,964,909
Clean-up	700	Acre	\$1,340	\$938,000
			Total	\$7,902,909

A detailed breakdown of the estimated repair and loss compensation per acre is provided in Exhibit 3J.

During the **20-year event**, the worst case scenario would be experienced involving a levee-overtopping to the south as well as failure of the north levee that would result in inundation of the 20-year flood zone. Damages would be incurred to over 1,700 acres of farmland, several residential developments and businesses, the Oceano Airport, and the regional Wastewater Treatment Plant that serves the communities of Arroyo Grande, Grover Beach and Oceano.

- The District estimated the costs for flooding repairs and replacement of losses at \$33,000 per home or business, based on the national average flood insurance claim payout for flood losses in 2009 according to the government website, www.floodsmart.gov (Exhibit 3K)
- The District estimated the costs of repairs and losses to the regional wastewater treatment plant at \$5,000,000 based on interview with wastewater treatment plant engineer (Exhibit 3L).
- The District estimated the costs of repairs and losses to the Oceano Airport at \$500,000, which includes costs to repair damage to both airplanes and runway (Exhibit 3L).

A detailed breakdown of the estimated repair and loss compensation for damages from the 20-year event is provided in Table 9-4.

Item	Quantity	Unit	Est. Repair/Loss Compensation	Total Damage
Crop Loss + Clean-up	1760	Acre	\$11,290	\$19,870,171
Single Family Residences	137	Home	\$33,000	\$4,521,000
Mobile Homes (in 4 parks)	400	Home	\$33,000	\$13,200,000
Manufacturing / Commercial	120	Business	\$33,000	\$3,960,000
South County Sanitation District	1	Facility	\$5,000,000	\$5,000,000
Oceano Airport	1	Facility	\$500,000	\$500,000
			Total	\$47,051,171

Event Damage

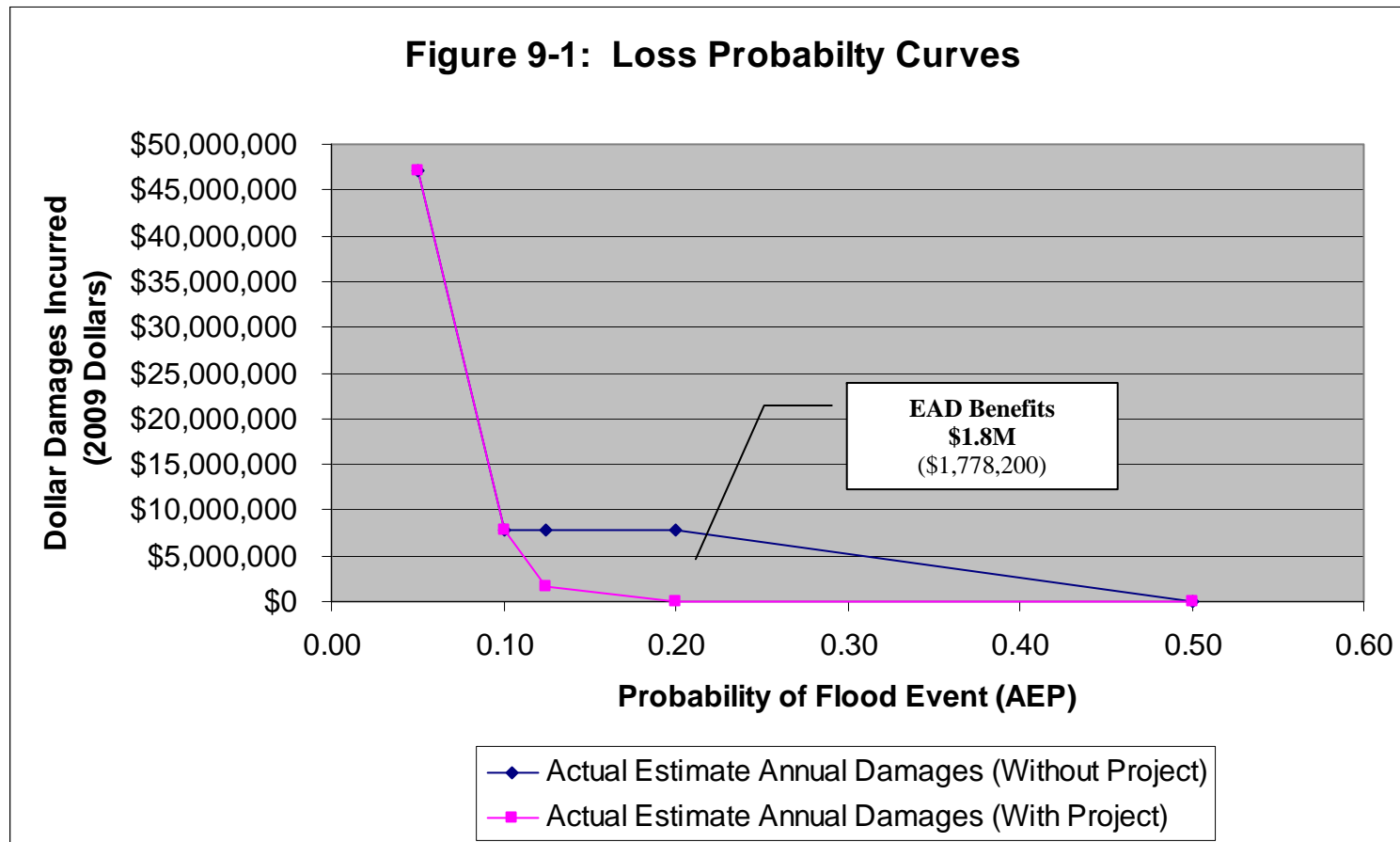
Table 9-5 summarizes the estimated event damage for the without- and with project condition. Event damage is greater for the without-project condition than for the with-project condition for all events through year eight (8), increasing the District's confidence in carrying a small storm (2-year event) and increasing the flood protection for the farmlands adjacent to the flood control channel for the more frequent storm events (5- and 8-year events).

Table 9-5: Event Damage							
Hydrologic Event	Event Probability	Damage if Flood Structures Fail	Probability Structural Failure		Event Damage		Event Benefit (Million \$)
			Without Project	With Project	Without Project	With Project	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
					(c) x (d)	(c) x (e)	(f) - (g)
2-year	0.50	\$7,902,909	0	0	\$0	\$0	\$0
5-year	0.20	\$7,902,909	1	0	\$7,902,909	\$0	\$7,902,909
8-year	0.13	\$7,902,909	1	0.2	\$7,902,909	\$1,580,582	\$6,322,327
10-year	0.10	\$7,902,909	1	1	\$7,902,909	\$7,902,909	\$0
20-year	0.05	\$47,051,171	1	1	\$47,051,171	\$47,051,171	\$0

The expected annual damage benefit of the project was estimated using the loss-probability curves shown in Figure 9-1 and is approximately \$1.8 million (for one year). The total present value of the expected annual damage over the life cycle of the project (50 years) is \$28,024,400. Table 9-6 illustrates how the total present value of expected annual damage over the project life of 50-years was estimated.

Table 9-6: Present Value of Expected Annual Damage Benefits Zone 1/1A WMP - 1st Year Vegetation and Sediment Management			
(a)	Expected Annual Damage Without Project ¹		\$3,349,600
(b)	Expected Annual Damage With Project ¹		\$1,571,400
(c)	Expected Annual Damage Benefit	(a) - (b)	\$1,778,200
(d)	Present Value Coefficient ²		15.76
(e)	Present Value of Future Benefits	(c) x (d)	\$28,024,400

1. This program assumes no population growth thus EAD will be constant over analysis period.
2. 6% discount rate; 50-year analysis period



Other Flood Damage Reduction Benefits

This section will describe the several other project benefits difficult to quantify including avoided emergency response costs, avoided public safety and health impacts, and avoided physical damage to ecosystems.

Avoided Emergency Response Costs

In order to alleviate the residual flood risk, consequences of capacity exceedance or project failure prior to capacity exceedance, the District has developed the Arroyo Grande Creek Levee Failure Emergency Response Plan (Exhibit 3M) that is activated once the water surface in the channel reaches approximately the 2-year flood elevation.

The District spends approximately \$20,000 annually in emergency planning which includes:

- Preparation and distribution of emergency response plan updates;
- County-wide staff training (including responding agencies such as Office of Emergency Services, Sheriff, Cal Fire, Red Cross, etc.);
- Distribution of flooding and evacuation safety information to the community of Oceano (Exhibit 3N); and
- Installation and maintenance of rain/stream gauge tools used in monitoring alert levels.

Actual costs for emergency response vary year to year depending on the rainfall. During the 2009-2010 rainy season, in which the Arroyo Grande Creek Watershed received 21.2 inches, just over the season average of 20 inches, the District spent over \$100,000 on emergency response activities including:

- Installation of temporary levee protection at 3 locations on the south levee that are predicted to overtop first, during the 5-year storm (\$86,000); and
- Implementation of emergency response plan which involves monitoring of rain/stream gauges during storm events, and conducting pre-, full-, and post-storm inspections.

Most recently on December 21, 2010, County issued a proclamation of local emergency due to the storm damage experienced throughout the County which included specific flood damages to Oceano residents and implementation of the Arroyo Grande Creek Levee Failure Emergency Response Plan. The total actual cost for the most recent emergency response is not available, however, is estimated at \$53,000. Emergency response efforts by the District included:

- Emergency maintenance to remove sediment blocking inlet culvert flap gates prior to storm flows;
- Emergency installation of temporary levee protection at 3 locations on the south levee that are predicted to overtop first, during the 5-year storm. District staff with assistance from the California Conservation Corp worked over the weekend to complete emergency installation prior to storm flows;
- Implementation of emergency response plan which involves monitoring of rain/stream gauges during storm events, and conducting pre-, full-, and post-storm inspections. Implementation resulted in numerous overtime hours for District staff during the holiday week;
- Mobilization of crew and equipment to remain on standby that would be necessary to remove a debris jam at structures (bridges crossing channel). Equipment on standby costs approximately \$350/day; and
- Implementation of voluntary evacuation of area south of the flood control channel. Implementation resulted in interdepartmental coordination involving Office of Emergency Services, Sheriff, Fire Department, and Red Cross. The Sheriff alone spent several hours route alerting (knocking on doors) to inform residents of high water levels in the adjacent flood control channel.

Response efforts by affected residents and businesses included:

- Evacuation of high-risk groups such as low-income, handicapped, and elderly;
- Evacuation of livestock. There is a horse ranch where approximately 40 horses were kept. Observations indicated that it took approximately 3 hours to transport the horses and feed to properties on the north side of the levee and on higher ground;
- Removal of farm equipment, supplies, etc; and
- Flood preparation including sand bagging and storage of belongings off the ground or to a second story.

The flood risk is greater for the without-project condition than for the with-project condition for all events through year eight (8), increasing the District's confidence in carrying a small storm (2-year event) and increasing the flood protection for the farmlands adjacent to the flood control channel for the more frequent storm events (5- and 8-year events).

The expected flood damage benefit related to avoided emergency costs is difficult to quantify, but as described above is significant to both the District implementing the emergency response and the residents and businesses effected by an imminent flood. While qualitative in nature, completion of the proposed project would provide immediate, increased flood protection correlating to reduce emergency response efforts and costs during the small (2-year) to mid-size (5-8 year) storms.

Avoided Public Safety and Health Impacts

The local threat of flood related damage due to a channel overtopping or levee failure is primarily confined to low-lying areas less than 50-feet above mean sea level, immediately adjacent to the Arroyo Grande Creek levees. (Critical facilities such as the Oceano Airport and regional wastewater treatment plant are immediately adjacent to the levees and at approximately 11 to 13-feet above mean sea level.) If the gradient is shallow, as it is in Oceano, flood waters can spread over a large area. The primary effects of a flood can be destruction and damage to low-lying areas.

The effects of a flood can range from insignificant damage to heavy damage with fatalities. The northern levee protects several residential developments, as well as the regional wastewater treatment plant that services the communities of Arroyo Grande, Oceano, and Grover Beach, and the Oceano Airport. If the north levee is overtopped or breached, risk to human life will be a threat. The southern levee protects hundreds of acres of farmland, several residences and businesses.

The north levee is maintained at a higher elevation (about 6-inches higher) to encourage an overtopping to the south rather than to the north. This policy will continue even with the completed project because residents within this flood plain would still be at risk, albeit with a smaller probability of flooding.

The completed project would improve flood protection during the smaller to midsize storms and therefore would indirectly provide increased public safety and health benefits to the disadvantaged community of Oceano. However, it would not remove the flood risk associated with living in the flood plain.

Avoided Loss of Ecosystems

The Arroyo Grande Creek is recognized as an anadromous, natural production steelhead stream. Limiting factors for Arroyo Grande Creek watershed include increasing sedimentation, decreasing spawning gravel quality and quantity, fish passage barriers, decreased water quantity, and increased water temperature due to a lack of canopy. The relatively good water quality in the watershed should be protected, as it is less expensive and more efficient to protect a water body's health than to remediate it once it has been impaired (Exhibit 3P - Arroyo Grande Creek Watershed Management Plan, Central Coast Salmon Enhancement, March 2005, page 2).

The 1st Year Vegetation and Sediment Management Project is designed to maintain balance between flood protection and protection of natural resources. The goal of the vegetation and sediment management activities is to increase flood capacity throughout the project reach while at the same time improving in stream aquatic habitat and reducing the need for sediment maintenance in the future.

The proposed vegetation management is designed to maintain a riparian buffer to create a continuous riparian canopy through the project area that provides benefit to terrestrial and aquatic species that rely on cover habitat, cool water temperatures and other functions provided by a continuous and diverse riparian corridor. Depending upon the maturity of the trees, the upper portion of the tree canopy would likely extend well beyond the buffer width. The buffer would also act to maintain a primary low-flow channel that has developed over the last several years by providing root strength along the low flow channel margins. To improve riparian habitat through the project area, existing gaps in the riparian buffer would be revegetated with native riparian species including cottonwood, sycamore, and willow.

The proposed sediment management portion of the project will enhance geomorphic function by initial removal of accumulated sediment to create secondary channels and integration of habitat enhancement structures consisting of large natural wood logs. In natural systems, the primary channel contains low flows, whereas secondary channels

become activated during higher flows that, on average, occur once a year (Exhibit 3Q - WMP, Figure 10). The Arroyo Grande Creek flood control channel currently lacks the secondary channels that are found in more natural, low gradient stream environments. Based on the current configuration of the primary (low flow) channel, secondary channels will crisscross the primary channel as the primary channel meanders between the levee side slopes (see Exhibit 3R - WMP Appendix B - Preliminary Engineering Design Plans).

During high flow events, the intersection of the primary and secondary channels are expected to be areas of complex flow conditions that will create localized eddies, backwaters, and scour. To take advantage of these high energy areas and encourage development of complex cover habitat for steelhead and red-legged frog, two types of large woody structures will be constructed at these locations. One type of large wood structure will be placed at the downstream end of each secondary channel as it conflues with the primary channel. The structure will provide protection from headcutting into the secondary channel and therefore enforce the location of the primary channel. The structure has also been designed to encourage pool scour at the confluence and mimic an undercut bank (similar to lunger structures traditionally used to enhance fish habitat). Because pool habitat and escape cover is lacking through the flood control reach, improvements to these physical habitat characteristics are expected to greatly improve aquatic habitat. In addition, these structures will provide escape cover for adults migrating through the reach to preferred spawning and rearing habitat areas that occur upstream of the flood control reach.

The second type of large wood structure would protect the head of bar that would exist at the downstream side of the confluence. This structure would also enforce maintenance of the primary and secondary channel locations and create a hard point that would encourage turbulence and creation of a pool at the confluence of the channels. Although both types of structures are designed to meet different habitat and channel stability objectives, they will promote pool scour, encourage variability in substrate and flow field conditions, and provide deep pools and cover habitat for steelhead and red-legged frog.

The combined vegetation and sediment management will “set” the flood control channel to an initial condition which mimics a natural system consisting of a primary low-flow channel supported by the presence of a stable riparian corridor. The completed project will enhance sediment transport and thereby reduce the need for future sediment removal projects providing continued ecosystem services to the existing sensitive species habitat found in both the flood control channel and upstream of it.

The associated value of the avoided loss of ecosystem would be equivalent to the value of proposed habitat enhancement of the flood control channel. This is based on the assumption that, if costs are incurred to avoid damages caused by lost ecosystem services, or to replace the services of ecosystems, then those services can be said to be worth at least what was incurred to replace them. The value of special species habitat and nursery services provided by the project could be measured by the cost of special species breeding and stocking programs that would be needed to maintain or improve existing populations. Typical annual costs for fish stocking programs (to the ocean) throughout the state are in the range of \$75,000 per 125,000 fish.¹ This would be a reasonable annual damage benefit; however, breeding and stocking programs are not currently permitted in areas where the species is threatened, such as Arroyo Grande Creek, in order to avoid the potential reduction in genetic vigor of wild fish. Therefore, special species population is most efficiently improved by maintaining and enhancing special species habitat. The associated value of this is difficult to calculate because once a species population is listed as threatened or endangered in a particular creek, it becomes increasingly expensive to improve habitat conditions for recovery and restoration of the species. To reiterate, it is less expensive and more efficient to protect a water body’s health than to remediate it once it has been impaired.

Although qualitative in nature, the associated avoided loss of ecosystem of this project is significant and will provide a benefit to the State of California.

¹ A local Chinook salmon ocean net-pen rearing program operated by Central Coast Salmon Enhancement raised and released 125,000 fish for \$130,000 in 2006.

Distribution of Benefits and Identification of Beneficiaries

This project provides increased local flood protection which directly benefits the agricultural land holders by reducing potential for crop loss, and indirectly protects the jobs and livelihood of farm workers in Oceano, a disadvantaged community. Providing improvements that will reduce the costs of inundation and loss of valuable crops and cropland is both a local and regional benefit. By protecting State listed species habitat, the project also provides statewide benefits by addressing recovery and restoration needs of public trust resources. In addition, this project's articulation with other listed species regional recovery and restoration programs strengthens the synergy of public trust resource protection and increases the available leverage to complete recommended projects in the Arroyo Grande Creek Watershed Management Plan (2009). Beneficiaries of recovery and restoration activities include citizens of and visitors to San Luis Obispo County for future sport fishing and passive recreational opportunities.

Benefits Timeline

Award of this grant would advance the completion date of this project 12 years to 2012. At that time, the increase in flood conveyance capacity will decrease the potential for flood damage to valuable farmland in the Cienega Valley. Better management and maintenance for vegetation and sediment in the channel will also decrease the likelihood of flooding with the implementation of the adopted Waterway Management Program and approval of permits for long-term maintenance. The 1st Year Vegetation and Sediment Management project is the necessary first step in full implementation of the Zone 1/1A Flood Management Program, and provides a critical reduction of flood risk as planning and funding efforts for the overall management program move forward.

Conclusions

The proposed project provides a net economic benefit, with a net present worth of approximately \$22,702,200. The present value cost of the Zone 1/1A Program is \$5,322,200. The present value benefit of the avoided flood damage is \$28,024,400.

Exhibit 3A

ALTERNATIVE 2 - VEGETATION MANAGEMENT AND SEDIMENT MANAGEMENT

INFRASTRUCTURE COST

ITEM	UNIT	COST/UNIT	# UNITS	YEARS	INFLATION	TOTAL COST
1ST YEAR VEGETATION MANAGEMENT	ACRES	\$7,500	11.56	1	--	\$ 86,700
1ST YEAR SEDIMENT MANAGEMENT	CY	\$20	22,626	1	--	\$ 452,520
HABITAT ENHANCEMENT (LOG STRUCTURES)	EA	\$2,500	20	1	--	\$50,000
SUBTOTAL						\$589,220
CONTINGENCY 20%						\$117,844
ADMINISTRATION AND PERMITTING 3%						\$17,677
ENGINEERING AND DESIGN 13%						\$80,647
TOTAL INFRASTRUCTURE COST						\$805,388

10-YEAR ESTIMATED MAINTENANCE COST

ITEM	UNIT	COST/UNIT	# UNITS	YEARS	INFLATION	TOTAL COST
YEARLY VEG. MANAGEMENT	YR	\$80,000	1	9	4%	\$ 1,024,785
YEARLY SEDIMENT MANAGEMENT	YR	\$140,000	1	9	4%	\$ 1,793,373
SUBTOTAL						\$ 2,818,157
CONTINGENCY 20%						\$ 563,631
ADMINISTRATION AND PERMITTING 3%						\$ 84,545
TOTAL 10 YEAR MAINTENANCE COST						\$ 3,466,334

TOTAL 10 YEAR COST \$4,271,722

ESTIMATED INDIRECT COST DUE TO FLOODING

ITEM	UNIT	COST/UNIT	# UNITS	YEARS	INFLATION	TOTAL COST
FARMLAND INUNDATION (700 ACRES EVERY 8.3YEARS)	ACRES/YR ¹	\$8,000	84	10	4%	\$ 9,947,242

¹ UNITS CALCULATED AS 700 ACRES / 8.3 YEARS

Exhibit 3B

ACKNOWLEDGEMENT OF TERMINATION DATE OF 1959 AGREEMENT

This Acknowledgement of Termination of 1959 Agreement (hereafter "Acknowledgement") entered into the 1ST day of December, 2009, between the San Luis Obispo County Flood Control and Water Conservation District, acting on behalf of Zones 1 and 1A (hereinafter referred to as "the County Flood Control District") and the Coastal San Luis Resource Conservation District (hereinafter referred to as the "RCD"), as successor in interest to the Arroyo Grande Soil Conservation District, and the Natural Resources Conservation Service (hereafter "NRCS"), of the United States Department of Agriculture, as the successor in interest to the Soil Conservation Service.

PREAMBLE

WHEREAS, the aforementioned parties (and/or their predecessors in interest) are partners to that certain "Watershed Protection Operation and Maintenance Agreement for Arroyo Grande Creek Channel and Los Berros Creek Diversion Improvements (Arroyo Grande Creek Watershed)" dated May 15, 1959 (the "1959 Agreement"); and

WHEREAS, the 1959 Agreement relates to the operation and maintenance of the following described works of improvement:

The Arroyo Grande Channel and appurtenances from the Pacific Ocean upstream for a distance of 2.84 miles, and the Los Berros Creek Diversion and appurtenances along an easterly line for a distance of 0.59 miles, from the Arroyo Grande Creek Channel to a point where the existing Los Berros Creek Channel emerges from the hills, as described in the "Watershed Work Plan ARROYO GRANDE CREEK," San Luis Obispo County, California.

WHEREAS, said works of improvement described in the 1959 Agreement are hereinafter referred to as the "Original Project"; and

WHEREAS, the Original Project has achieved its intended purpose, and alterations to the Original Project's purpose, design and maintenance are necessary to accommodate changing regulations, watershed hydrology, and waterway management planning; and

WHEREAS, although the 1959 Agreement has no express termination date, the parties agree that the 1959 Agreement has an implied term of 50 years.

ACKNOWLEDGEMENT

NOW, THEREFORE, the County Flood Control District, RCD, and NRCS mutually agree as follows:

1. The parties agree that the above recitals in the Preamble are true and correct, and are incorporated herein by reference.
2. The parties hereby acknowledge, and mutually agree, that the 1959 Agreement shall be deemed terminated as of May 15, 2009.

**SAN LUIS OBISPO COUNTY FLOOD
CONTROL AND WATER CONSERVATION
DISTRICT**

By 
Chairperson of the Board of Supervisors

Dated: December 1, 2009

ATTEST:
JULIE RODEWALD
County Clerk and Ex-Officio Clerk of the
Board of Supervisors

By: 
Deputy Clerk

Dated: December 1, 2009

**APPROVED AS TO FORM AND LEGAL
EFFECT:**

WARREN R. JENSEN
County Counsel

By 
Patrick Foran
Deputy County Counsel

Dated: 6/25/09

**COASTAL SAN LUIS RESOURCE
CONSERVATION DISTRICT**

By: 
Neil Havlik, President

Dated: 8/21/09

ATTEST:

RCD

**NATURAL RESOURCE CONSERVATION
SERVICE, UNITED STATES OF DEPT. OF
AGRICULTURE**

By: _____

Name: _____

Title: _____

Dated: _____

PJF/nw
083005 / 1125nwagr.doc

**APPROVED AS TO FORM AND LEGAL
EFFECT:**

WARREN R. JENSEN

County Counsel

By



Patrick Foran

Deputy County Counsel

Dated:

6/25/09

**COASTAL SAN LUIS RESOURCE
CONSERVATION DISTRICT**

By:

Neil Havlik, President

Dated:

ATTEST:

RCD

**NATURAL RESOURCE CONSERVATION
SERVICE, UNITED STATES OF DEPT. OF
AGRICULTURE**

By:



Name:

Gayle Norman

Title:

Acting State Consyst.

Dated:

9/29/2009

PJF/nw

083005 / 1125nwagr.doc

Exhibit 3C

Arroyo Grande Creek and other major waterways throughout the area. With the protection of Lopez Dam, the city has been spared major flooding, however localized flooding continues to impact the city.

“Major floods in 1973 and 1983 and the extremely severe storms of 1995 and 1997 continue to emphasize the need for damage improvement. As part of the extensive study of the flood control situation, an examination of current deficiencies and the condition that causes the problem was made. Additionally, a field review during storm seasons was vital in pinpointing problem areas.”(8)

Flood of March 2001

Just as this book is being prepared for publication, the inevitable has happened: heavy rains in the month of February and early March has caused a flooding of the Arroyo Grande Creek over the farm lands and some homes in the lower Arroyo Grande Valley. Rainfall of approximately 7 inches in February plus 4 inches Sunday night, March 4, and early Monday, the 5th, with a season total of about 16 inches caused the creek to rise above its banks as it flowed through the Arroyo Grande Watershed. As it rushed to the ocean it picked up all types of debris including fallen trees. When it came to the flood control channel in Oceano it passed the 22nd Street Bridge and Southern Pacific Railroad Bridge with such force that the water plus the debris was enough to break about a 150 foot gap in the flood control levee, causing a devastating flood onto the farm area adjacent to the creek, with hundreds of acres being inundated with water.

Jasmine Marshall writes in the Times-Press-Recorder, March 7, 2001, “One of the hardest-hit areas was Bejos Seeds Inc., a national distributor of vegetable produce seeds. The farm experienced approximately \$500,000 in losses due to the onslaught of the water that

inundated the fields. ... One bright spot for Bejos Seeds was assistance from a neighboring farm, Phelan & Taylor Produce Co., which allowed Bejos Seeds to move its stock to a warehouse on higher ground. Phelan and Taylor, a vegetable farm that grows broccoli and cauliflower, was also hit hard by the levee break. John Taylor said parts of his field were still under 10 to 12 feet of water Tuesday.” (11)

Immediately work crews went to work to repair the levee in order to prepare for any additional storms in the 2001 rainy season. In an article from the same newspaper, Karen White states, “The creek channel, developed in 1958 as a Soil Conservation project, (see chapter 3) is now considered property of the Templeton-based National Conservation Resource Service (NCRS) of San Luis Obispo County, according to Margie Linguist, administrator. The NCRS will provide money to repair the levee, with engineering by its Emergency Watershed Protection program. Joining them will be technical help from the U.S. Army Corp. of Engineers.” (11)

It is evident that these last three miles of the Arroyo Grande Creek, with its built-up levees, is not a riparian creek, but a flood control channel. To maintain it as such is a problem that must be solved. Personnel from San Luis Obispo County, the City of Arroyo Grande, the Coastal San Luis Resource Conservation District, local farmers, environmentalists, and many others are working together to try to do just this. On November 18, 1999, a meeting was held at the Arroyo Grande City Hall with these groups to plan a working solution to the current flooding problems in this area. A follow-up meeting was held in November 2001.

See Chapter 3 for details of the earlier steps taken to control the flooding conditions, and Chapter 7 for current steps being taken to reduce flooding of the Arroyo Grande Creek.

Exhibit 3D

STATE. California
EWP PROJECT: Arroyo Grande Levee
Repair
AGREEMENT NO.: 69-9104-1-197

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

COOPERATIVE AGREEMENT - LOCALLY AWARDED CONTRACT

THIS AGREEMENT is between the San Luis Obispo County Flood Control and Water Conservation District, hereinafter called the *Sponsor*; and the Natural Resources Conservation Service, United States Department of Agriculture, hereinafter called *NRCS*.

WITNESSETH THAT:

WHEREAS, under the provisions of Section 216 of Public Law 81-516, Emergency Watershed Protection Program, and Title IV of the Agricultural Credit Act of 1978, Public Law 95-334, NRCS is authorized to assist the Sponsor in relieving hazards created by natural disasters that cause a sudden impairment of a watershed, and

WHEREAS, NRCS and the Sponsor agree to install emergency watershed protection measures to relieve hazards and damages created by storms of 2001.

NOW, THEREFORE, in consideration of the premises and of the several promises to be faithfully performed by the parties hereto as set forth, the Sponsor and NRCS do hereby agree as follows:

- A. It is agreed that the following described work is to be constructed at an estimated cost of \$400,000.00.

*Levee repair, channel clearing, and debris removal along
Arroyo Grande Channel, DSR #01-01-2705*

B. The Sponsor will:

1. Provide 25 percent of the cost of the construction described in Section A through cash contribution and/or in-kind services approved in this agreement.

Be allowed 12.5 percent for in-kind services of the final cost of construction toward the Sponsor's cost share. In-kind services approved are for preparation of plans and specifications and contract documents and inspection of work. The Sponsor's cash contribution is 12.5 percent of the cost of

of 5

performing the works of restoration described in Section A.
The Sponsor's cash contribution is estimated to be \$50,000.00.

2. Designate the following individual as the liaison between the Sponsor and NRCS.

Glen L. Priady

(Name)

Room 207, County Government Center

(Street)

San Luis Obispo, CA 93408

(City and State)

(805) 781-5292

(Phone)

- Prepare a design, construction specifications, and drawings in accordance with standard engineering principles and be in compliance with programmatic requirements. The construction plans shall be reviewed and approved by the Sponsor prior to submittal to NRCS. The construction plans for measures other than stream debris removal and disposal will be reviewed and approved by a Professional Engineer registered in the State of California prior to submittal to NRCS.
- Provide certification that real property rights have been obtained for installation of emergency watershed protection measures prior to advertising. Certification will be provided on Form NRCS-ADS-78, Assurances Relating to Real Property Acquisition, as amended (no attorney's opinion is required).
- Accept all financial and other responsibility for excess costs resulting from their failure to obtain, or their delay in obtaining, adequate land and water rights, permits, and licenses needed for the emergency watershed protection measures described in Section A.
- Contract for construction of the emergency watershed protection measures described in Section A in accordance with applicable state requirements.
- Comply with the applicable requirements in Attachments A and B to this agreement.
- Ensure that all contracts for construction of emergency watershed protection measures include the provisions contained in Attachment B to this agreement.

Page 3 of 6

9. Provide copies of site maps to appropriate Federal and State agencies for environmental review. Sponsor will notify NRCS of environmental clearance, modification of construction plans, or any unresolved concerns prior to award of the contract(s) for construction of the emergency watershed protection measures.
10. Ensure that requirements for compliance with environmental and/or cultural resource laws are incorporated into the project.
11. Pay the contractor as provided in the contract(s). Submit billings for reimbursement to NRCS on Form SF-270, Request for Advance or Reimbursement with supporting documentation.
12. Take reasonable and necessary actions to dispose of all contractual and administrative issues arising out of the contract(s) awarded under this agreement. This includes, but is not limited to, disputes, claims, protests of award, source evaluation, and litigation that may result from the project. Such actions will be at the expense of the Sponsor including legal expenses.
13. Arrange for and conduct final inspection of completed emergency watershed protection measures. Certify that the project was installed in accordance with contractual requirements.
14. Upon acceptance of the work from the contractor(s), assume responsibility for operation and maintenance, as applicable.
15. Hold and save NRCS free from any and all claims or causes of action whatsoever resulting from the obligations undertaken by the Sponsor under this agreement or resulting from the work provided for in this agreement.
16. Retain all records dealing with the award and administration of the contract(s) for 3 years from the date of the Sponsor's submission of the FINAL Request for Reimbursement or until final audit findings have been resolved, whichever is longer. If any litigation is started before the expiration of the 3-year period, the records are to be retained until the litigation is resolved or the end of the 3-year period, whichever is longer. Make such records available to the Comptroller General of the United States or his or her duly authorized representative and accredited representatives of the U.S. Department of Agriculture or cognizant audit agency for the purpose of making audit, examination, excerpts, and transcripts.

Page 4 of 6

17. Work with and recognize NRCS in any public or legislative outreach deemed appropriate for aiding citizens in understanding the use of public funds and repair of watersheds undertaken as a result of this cooperative venture.

C. NRCS will:

1. Provide 87.5 percent of the cost of constructing the emergency watershed protection measures described in Section A which includes 12.5 percent approved for in-kind services toward the Sponsor's 25 percent cost share. This cost to NRCS is estimated to be \$350,000.00. If construction is not completed, NRCS is under no obligation for in-kind services incurred by the Sponsor.
2. Not be substantially involved with the technical or contractual administration of this agreement. However, NRCS will provide advice and counsel as needed.
3. Review and approve construction plans as identified in Section B.3 of this agreement.
4. Make payment to the Sponsor covering NRCS's share of the cost upon receipt and approval of Form SF-270, Request for Advance or Reimbursement.
5. Be available to conduct progress checks and participate in final inspections.
6. Designate the following individual as the liaison between the Sponsor and NRCS.

Margy Lindquist, District Conservationist
(Name)

65 Main Street, Suite 108
(Street)

Templeton, California
(City and State)

(805) 434-0396
(Phone)

D. It is mutually agreed that:

1. This agreement is effective the date it is fully executed by all parties to this agreement. It shall become null and void

Page 5 of 6

- 90 calendar days after the date NRCS has executed this agreement if a contract has not been awarded.
2. The furnishing of financial and other assistance by NRCS is contingent upon the continuing availability of appropriations by Congress from which payment may be made and shall not obligate NRCS if Congress fails to so appropriate.
 3. The contract for performing the work described in Section A will not be awarded to the Sponsor, or to any firm in which any Sponsor official or any member of such official's immediate family has direct or indirect interest in the pecuniary profits or contracts of such firms.
 4. This agreement may be temporarily suspended by NRCS if NRCS determines that corrective action by the Sponsor is needed to meet the provisions of this agreement. Further, NRCS may suspend this agreement when it is evident that a termination is pending.
 5. NRCS may terminate this agreement in whole or in part if it is determined by NRCS that the Sponsor has failed to comply with any of the conditions of this agreement. NRCS shall promptly notify the Sponsor in writing of the determination and reasons for the termination, together with the effective date. Payments made by or recoveries made by NRCS under this termination shall be in accord with the legal rights and liabilities of NRCS and the Sponsor.
 6. This agreement may be renegotiated, amended, extended, or modified by a written amendment as mutually agreed by both parties.
 7. The program or activities conducted under this agreement will be in compliance with the nondiscrimination provisions contained in Titles VI and VII of the Civil Rights Act of 1964, as amended; the Civil Rights Restoration Act of 1987 (Public Law 100-259); and other nondiscrimination statutes: namely, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, and American's With Disabilities Act of 1990. They will also be in accordance with regulations of the Secretary of Agriculture (7 CFR-15, Subparts A & B), which provide that no person in the United States shall on the grounds of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving federal

Page 6 of 6

financial assistance from the U.S. Department of Agriculture
or any agency thereof.

SAN LUIS OBISPO COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

By: *Dana C. [Signature]*
Title: Co. Administrator
Date: 3/9/01

This action authorized at an
official meeting of the sponsor
on the 09 day of March
2001, at SAN LUIS OBISPO, CA
(city) (State)

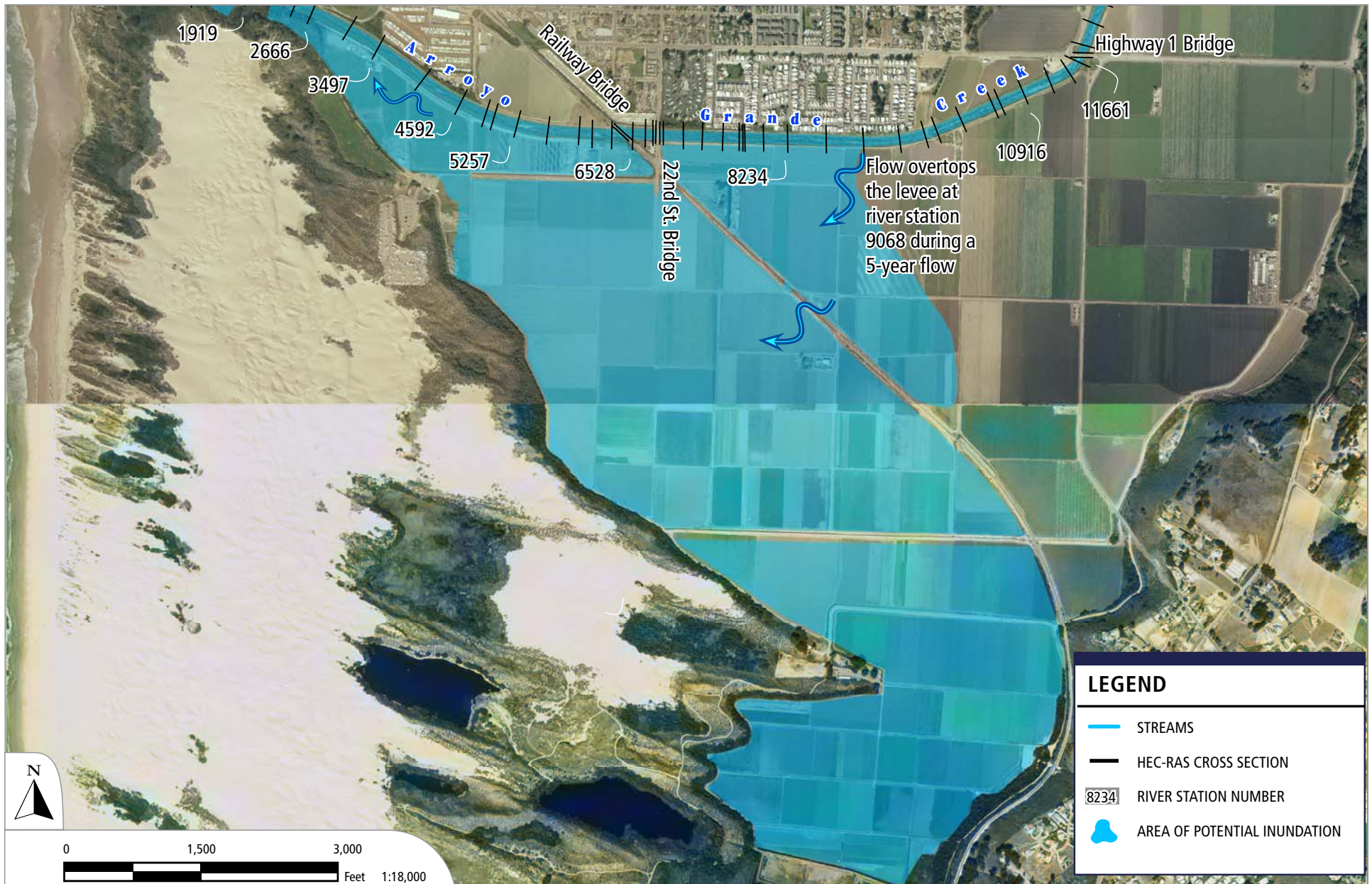
[Signature]
(Attest Signature) 176m B-23

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

By: *Raymond Miller*
Title: Contract Specialist
Date: 3/9/01



Exhibit 3E



SWANSON HYDROLOGY + GEOMORPHOLOGY
 500 Seabright Ave, Suite 202 Santa Cruz, CA 95062
 PH 831.427.0288 FX 831.427.0472

FIGURE 3.2: Estimated area of flooding during a 5-year event assuming a levee overtop rather than a levee failure. Area of inundation was estimated to be approximately 700 acres. The area of inundation would differ under higher peak events or levee failure.

Exhibit 3F

2.2. HYDROLOGIC AND HYDRAULIC MODELING

2.2.1. TOPOGRAPHIC SURVEYS

An aerial photogrammetric survey of the project area was performed on March 10, 2005 by Central Coast Aerial Mapping, Inc., under subcontract with SH+G. The survey was tied to photo control points set by Cannon & Associates, Inc., using GPS survey equipment. The products of the aerial survey include a set of digital ortho-rectified color images of the project area as well as a topographic map showing two-foot contours in areas where the ground surface was not obscured by vegetation, standing water, or other obstructions.

To augment and improve upon topographic data collected remotely, SH+G conducted a ground-based survey that mapped cross sections along the project reach. Cross-section data was collected from the Valley Road Bridge on Los Berros Creek to the confluence with Arroyo Grande Creek and then extending from the confluence with Los Berros Creek on the Arroyo Grande mainstem downstream to the mouth of Arroyo Grande Creek at the Pacific Ocean. In addition, the ground survey extended approximately 200 feet up Arroyo Grande Creek from its confluence with Los Berros Creek to capture the remaining portion of the flood control reach and to establish boundary conditions. The survey was conducted using an electronic total station and data collector. A traverse was run along the levee crests, with periodic field ties made to the aerial photo control points set by Cannon & Associates, Inc. The purpose of the survey was to obtain detailed data at bridges and in locations where tree cover or other obstructions made aerial mapping impossible, including areas inundated with water at the time of the aerial mapping. Cross sections were surveyed approximately every 500 feet, with additional sections mapped at locations of hydraulic significance.

2.2.2. HEC-RAS MODEL DEVELOPMENT

The existing-conditions HEC-RAS model was developed using *Geo-RAS* software to sample cross sections from the topographic base map. Sections were sampled approximately every 200 feet, with additional sections placed at locations of hydraulic significance.

Manning's roughness ("n") values for the model were determined from field observations and a review of aerial and ground photographs taken in March of 2005. Field data and photos for the roughness survey are included as an appendix to the digital version of this report (Appendix C). An average composite roughness value of 0.057 was calculated (Figure 2.2) for the project area, with composite roughness for individual cross sections varying between .037 and .07. Bridge geometry was input to the model from field survey measurements taken in March of 2005.

Note: Maximum capacity
without freeboard:
2,500 cfs

Composite $n=0.057$

$n=0.07$

$n=0.035$

$n=0.07$

Levee

Levee

2 ft Freeboard*

Capacity with
2 ft Freeboard:
1,300 cfs
2.8-year flow

FLOOD CONTROL CHANNEL

* Freeboard is the distance from the water's surface to the lowest levee crest.

FIGURE 2.2: Schematic diagram of existing conditions on the Arroyo Grande Creek flood control channel. A average composite Manning's roughness value (n) of 0.057 was estimated for the hydraulic modeling effort based on field observations in summer 2005.

Exhibit 3G

Levels of Protection

Flood risk management projects are often characterized as having a certain “level of protection” (for example, 100- or 200- year). Often these labels are misleading because of (a) the inherent uncertainties in their estimation, (b) the wrong connotations they sometimes give to the public (i.e., a 100-year flood will only occur once every 100 years), and (c) they ignore residual risk. However, despite these limitations, it is still necessary to report levels of protection (without- and with-project) using consistent methods.

The two primary methods of measuring levels of protection include:

- **Deterministic method:** this method relies on defining a potential water surface elevation for a specific frequency flow event and then applying a specific freeboard on top of this water surface elevation to account for uncertainty. Often the freeboard is three feet, but it can be higher depending on local conditions. The water surface elevation would be determined by traditional hydrologic, hydraulic and related methods. No uncertainty in these parameters would be considered.
- **Probabilistic method:** directly incorporates “risk-based” analysis, usually using the HEC-FDA model and the project performance statistics; uncertainty in each of the major physical parameters is considered. The USACE uses the conditional non-exceedence statistic to certify to FEMA that levees and other flood structures meet the 100-year standard (i.e., it must be shown that there is at least a 90% confidence of passing the 100-year event).²⁸

Figure 4 illustrates the differences between these approaches for a levee project being designed to provide 100-year level of protection (note: the probabilistic method may result in a levee height that is greater, lesser or equal to that determined by the deterministic method).

²⁸ For more information on levee certification issues, see the DWR *Quick Guide* at <http://www.fpm.water.ca.gov/docs/CAQG-screen.pdf>

Exhibit 3H



COUNTY OF SAN LUIS OBISPO
Department of Agriculture/Weights and Measures

2156 SIERRA WAY, SUITE A, SAN LUIS OBISPO, CALIFORNIA 93401-4556
ROBERT F. LILLEY
AGRICULTURAL COMMISSIONER/SEALER
www.sloag.org

April 1, 2010

Contact: Bob Lilley, County Ag Commissioner/Sealer
805-781-5924

FOR IMMEDIATE RELEASE

Crop Statistics for 2009 for San Luis Obispo County Released.

2009 Production, Valued at \$623,095,000, Increased 3% Compared to 2008.

SAN LUIS OBISPO, CA April 1, 2010—The San Luis Obispo County Department of Agriculture/Weights and Measures is pleased to announce the release of annual production statistics for the local agricultural industry for 2009. Statistics can be found on the Department's website at www.slocounty.ca.gov/agcomm. Hard copies of the annual report will be available in June.

Total crop values for 2009 are estimated at a gross value of \$623,095,000 compared to \$602,922,000 for 2008. This increase is an improvement of approximately 3%, according to Bob Lilley, County Agricultural Commissioner. "Many growers continued to feel the negative effects of the four year drought in 2009. However, other than the lack of rainfall, the overall mild winter and summer temperatures provided ideal growing conditions for some of the county's crops", continued Lilley.

Wine grapes continue to hold the top position in overall value. Favorable weather conditions contributed to a 42% increase in yields over 2008 tonnage totals. The prices for San Luis Obispo County's grapes declined slightly, however higher yields created a 34% overall increase in value compared to 2008. Wine Grape values were \$166,378,000 or 27% of the combined value of the County's entire agricultural industry.

The strawberry industry expanded by 370 acres to 1893 total acres, a 24% increase over 2008. Despite lower prices compared to 2008 levels, the local industry was valued at \$73,198,000, an increase of approximately 12% over 2008.

Coastal avocado and Valencia orange trees suffered fruit loss due to one week of unusually high temperatures in June, 2009, resulting in significantly lower yields, compared to 2008. Lemon yields were high, but reduced consumer demand caused prices to fall.

##more##

VEGETABLE CROPS

CROP	YEAR	HARVESTED ACREAGE	PRODUCTION		UNIT	PER UNIT	TOTAL
			PER ACRE	TOTAL			
Bell Peppers	2009	822	1,153.0	947,766	30#	7.59	\$7,194,000
	2008 **	937	1,091.0	1,022,267	30#	6.80	\$6,951,000
Bok Choy	2009 +	427	814.0	347,578	80#	8.87	\$3,083,000
Broccoli (All)	2009	12,909	547.0	7,061,223	23#	8.52	60,162,000
	2008 **	14,977	565.0	8,462,005	23#	8.32	70,404,000
Cabbage	2009	653	1,341.0	875,673	45#	7.67	6,716,000
	2008 **	977	772.0	754,244	45#	8.70	6,562,000
Cauliflower	2009	1,533	831.0	1,273,923	25#	10.69	13,618,000
	2008	1,567	666.0	1,043,622	25#	8.70	9,080,000
Celery	2009	787	1,160.0	912,920	60#	8.93	8,152,000
	2008 **	953	1,212.0	1,155,036	60#	9.83	11,354,000
Lettuce, Head	2009	5,312	591.0	3,139,392	50#	8.83	27,721,000
	2008 **	5,106	682.0	3,482,292	50#	6.84	23,819,000
Lettuce, Leaf	2009	2,163	482.0	1,042,566	25#	11.81	12,313,000
	2008 **	2,112	547.0	1,155,264	25#	11.95	13,805,000
Napa Cabbage (Oriental Vegetables)	2009 +	1,294	877.0	1,134,838	80#	9.61	10,906,000
	2008 **	1,185	835.0	989,475	80#	11.37	11,250,000
Peas Edible Pod	2009	361	245.0	88,445	10#	8.26	731,000
	2008	547	332.0	181,604	10#	10.40	1,889,000
Spinach	2009	834	463.0	386,142	20#	12.54	4,842,000
	2008	1,007	506.0	509,542	20#	11.77	5,997,000
Squash	2009	242	758.0	183,436	30#	7.37	1,352,000
	2008	278	771.0	214,338	30#	5.86	1,256,000
* Miscellaneous	2009	4,589					30,519,000
	2008 **	6,125					37,411,000
TOTAL VEGETABLE CROPS	2009	31,926					\$187,309,000
	2008 **	35,771					\$199,778,000

* Anise, Artichokes, Arugula, Beans, Beets, Brussel Sprouts, Carrots, Chard, Chili Peppers, Cilantro, Collards, Cucumbers, Daikon, Dandelion, Dill, Endive, Escarole, Garlic, Green Garbanzo Beans, Herbs, Kale, Leeks, Melons, Mushrooms, Mustard, Onions, Parsley, Potatoes, Pumpkins, Radicchio, Radishes, Rutabagas, Sweet Corn, Tomatillos, Tomatoes, Turnips

** Revised

+ Formerly reported as Oriental Vegetable

FRUIT & NUT CROPS

CROP	YEAR	ACREAGE		PRODUCTION		UNIT	PER UNIT	TOTAL
		PLANTED	BEARING/ HARVESTED	PER ACRE	TOTAL			
Avocados	2009	4,800	3,919	0.922	3,613	Ton	2,551.00	\$9,218,000
	2008 **	4,800	3,919	1.354	5,306	Ton	2,060.00	\$10,931,000
Grapes, Wine (All)	2009	36,276	34,100		147,380	Ton		166,378,000
	2008	36,845	34,622		103,507	Ton		124,126,000
Chardonnay	2009		3,481	6.192	21,554	Ton	1,289.00	27,784,000
	2008		3,109	5.516	17,149	Ton	1,445.00	24,781,000
Sauvignon Blanc	2009		983	6.025	5,923	Ton	920.00	5,449,000
	2008		1,147	3.660	4,198	Ton	962.00	4,038,000
White Wine (Other)	2009		1,763	4.933	8,697	Ton	1,212.00	10,541,000
	2008		2,053	3.221	6,613	Ton	1,373.00	9,079,000
Cabernet Sauvignon	2009		11,280	3.993	45,041	Ton	1,031.00	46,437,000
	2008		11,377	2.408	27,396	Ton	1,005.00	27,533,000
Merlot	2009		4,765	5.060	24,111	Ton	829.00	19,988,000
	2008		4,934	3.081	15,202	Ton	898.00	13,651,000
Pinot Noir	2009		1,905	2.299	4,380	Ton	2,714.00	11,887,000
	2008		1,548	1.866	2,889	Ton	3,107.00	8,975,000
Syrah	2009		3,525	2.986	10,526	Ton	1,188.00	12,504,000
	2008		3,550	2.517	8,935	Ton	1,261.00	11,267,000
Zinfandel	2009		2,883	3.812	10,990	Ton	1,106.00	12,155,000
	2008		3,253	3.025	9,840	Ton	1,064.00	10,470,000
Red Wine (Other)	2009		3,515	4.597	16,158	Ton	1,215.00	19,633,000
	2008		3,651	3.091	11,285	Ton	1,270.00	14,332,000
Lemons	2009	1,634	1,542	20.058	30,929	Ton	198.00	6,124,000
	2008	1,634	1,532	14.171	21,852	Ton	599.00	13,089,000
Strawberries (All)	2009		1,893		57,890	Ton		73,198,000
	2008		1,523		45,660	Ton		65,481,000
Fresh	2009			21.918	41,491	Ton	1,533.00	63,605,000
	2008			21.610	32,912	Ton	1,708.00	56,214,000
Processed	2009			8.663	16,399	Ton	585.00	9,593,000
	2008			8.370	12,748	Ton	727.00	9,267,000
Valencia Oranges	2009	304	304	6.015	1,829	Ton	261.00	477,000
	2008	304	304	21.262	6,464	Ton	137.00	886,000
English Walnuts	2009	2,371	2,330	0.330	769	Ton	1,796.00	1,381,000
	2008 **	2,371	2,330	0.233	543	Ton	2,413.00	1,310,000
* Miscellaneous	2009	2,788	1,946					14,698,000
	2008	3,173	2,083					13,838,000
TOTAL FRUIT & NUT CROPS	2009	48,173	46,034					\$271,474,000
	2008 **	49,127	46,313					\$229,661,000

* Almonds, Apples, Apricots, Asian Pears, Blueberries, Bushberries, Cherries, Feijoas, Grapefruit, Kiwis, Mandarin Oranges, Navel Oranges, Nectarines, Olives, Peaches, Pears, Persimmons, Pistachios, Pomegranates, Quince, Specialty Citrus, Table Grapes, Tangerines

** Revised

FIELD CROPS

CROP	YEAR	ACREAGE		PRODUCTION		UNIT	VALUE	
		PLANTED	HARVESTED	PER ACRE	TOTAL		PER UNIT	TOTAL
Alfalfa Hay	2009	2,001	2,001	5.89	11,786	Ton	\$132.00	\$1,556,000
	2008	2,119	2,119	6.42	13,604	Ton	\$237.00	\$3,224,000
Barley	2009	12,465	8,593	0.71	6,101	Ton	144.00	879,000
	2008	8,288	6,015	0.91	5,474	Ton	214.00	1,171,000
++ Grain Hay	2009	11,376	10,237	1.66	16,993	Ton	116.00	1,971,000
	2008	12,355	11,275	1.62	18,266	Ton	205.00	3,744,000
Grain Stubble (Grazed)	2009		10,098			Acre	11.00	111,000
	2008		9,910			Acre	10.00	99,000
Rangeland, Grazed	2009		1,025,000			Acre	9.00	9,225,000
	2008		1,025,000			Acre	8.00	8,200,000
* Miscellaneous	2009	2,688	3,313					1,436,000
	2008 **	8,655	6,264					1,352,000
TOTAL FIELD CROPS	2009	28,530	1,059,242					\$15,178,000
	2008 **	31,417	1,060,583					\$17,790,000

* Irrigated Pasture, Garbanzo Beans, Oats, Safflower, Wheat, Field seed

++ Includes winter forage

** Revised

Exhibit 3J

Estimated Crop Loss and Clean Up Cost
for Flooding during the 5, 8, and 10 year Events

Estimated Proportion of Typical Crops Harvested in the 5-year Flood Area (~700 acres)

Typical Crops	2009 Harvested	% of Total	Typical Crop
Bell Peppers	822	4.75%	33.3
Cabbage	653	3.78%	26.4
Celery	787	4.55%	31.9
Lettuce, head	5,312	30.71%	215.0
Lettuce, leaf	2,163	12.51%	87.5
Spinach	834	4.82%	33.8
Squash	242	1.40%	9.8
Misc: Brussel Sprouts, Endive, Onions, Tomatoes	4,589	26.53%	185.7
Strawberries	1,893	10.95%	76.6
Total Harvested Acreage of Typical Crops	17,295	100.00%	700.0

Potential Annual Crop Revenue

Crops	Potential Annual	Potential		Unit	Per Unit	Total
		per Acre	Total			
Bell Peppers	33.3	1153	38,360	30#	\$7.59	\$291,152
Cabbage	26.4	1341	35,442	45#	\$7.67	\$271,841
Celery	31.9	1160	36,950	60#	\$8.93	\$329,960
Lettuce, head	215.0	591	127,064	50#	\$8.83	\$1,121,976
Lettuce, leaf	87.5	482	42,197	25#	\$11.81	\$498,346
Spinach	33.8	463	15,629	20#	\$12.54	\$195,985
Squash	9.8	758	7,424	30#	\$7.37	\$54,718
Misc: Brussel Sprouts, Endive, Onions, Tomatoes	185.7	1	186	acre	\$6,650.00	\$1,235,143
Strawberries	76.6	30.6	2,344	Ton	\$1,265.00	\$2,965,788
Potential Annual Harvested Acreage Total	700.0	Potential Annual Crop Revenue Total				\$6,964,909
		Potential Annual Crop Revenue				\$9,950

Assumptions:

1. Farm fields capable of 2 to 3 crops each year and that flooding would make fields inoperable for at least one (1)
2. Typical crops being brussel sprouts, celery, cabbage, endive, lettuce, onions, peppers, spinach, squash, tomatoes, cherry tomatoes, and strawberries.
3. Harvested acreage, per acre, and per unit crop values taken from the 2009 SLO County Crop Report prepared by the SLO County Agriculture Dept.

Estimated Crop Loss and Clean Up Cost
for Flooding during the 5, 8, and 10 year Events

Estimated Clean up Cost

Item	Quantity	Unit	Est. Repair	Total Damage
Set-up of Temporary Pump ¹	1	LS	\$1,200	\$1,200
Operation of Temporary Pump ^{2,3}	50	Day	\$500	\$25,000
Take-down of Temporary Pump ¹	1	LS	\$1,200	\$1,200
Debris Removal/Disposal	700	Acre	\$1,300	\$910,000
Total Clean-up Cost				\$937,400
Clean-up Cost per Acre				\$1,339.14

Assumptions:

1. Cost for 2 PW Worker III's to assemble/disassemble temporary piping and connect temporary pump (16 hours)
2. Operation costs includes \$300 for fuel plus time for 1 PW Worker III to perform one service check during a single 24-hour operation period.
3. Flooded depth of 4-feet over 700 acres. Duration of pumping activity based on time to pump 2,800 acre-feet (~122M cubic feet) of water back into the channel using the District's trailer mounted pump (~30 cfs capacity).
4. Debris Removal / Disposal unit cost based on estimated cost to clear and grub fields to help aerate soil for drying and remove contaminated top soil. Clearing and grubbing costs assumed to be \$0.03/SF or \$1,306/acre, based on *SLO County Public Works Department Bonding Estimate - County Approved Unit Costs, 2009*.

Exhibit 3K

Protect Yourself with Flood Insurance

Just a few inches of water from a flood can cause tens of thousands of dollars in damage. Over the past 10 years, the average flood claim has amounted to over \$33,000. Flood insurance is the best way to protect yourself from devastating financial loss.

Flood insurance is available to homeowners, renters, condo owners/renters, and commercial owners/renters. Costs vary depending on how much insurance is purchased, what it covers, and the property's flood risk.

All policy forms provide coverage for buildings and contents. However, you might want to discuss insuring personal property with your agent, since contents coverage is optional. Typically, there's a 30-day waiting period—from date of purchase—before your policy goes into effect. That means now is the best time to buy flood insurance.

Insurance for a [Homeowner](#) >>

Insurance for a [Renter](#) >>

Insurance for a [Condo Owner or Renter](#) >>

Learn your risk, and find an agent, by taking Your Risk Profile.

Exhibit 3L



"Julie Thomas"
<jthomas@coastalrcd.org>

12/19/2007 01:40 PM

Please respond to
<jthomas@coastalrcd.org>

To <dhollowell@morrogroup.com>, <jwerst@co.slo.ca.us>

cc

bcc

Subject Costs estimates for hypothetical flooding in Zone 1/1A

Hi Deb, Jeff

I spoke with Pamela Mitchell of SLO County Liability and Claims, who spoke with Deb Hosli, and it appears that the County does not have any projections of costs of flooding in Zone 1/1A. All they have is a record of the payouts from the 2001 flood: 16 claimants, \$1,000,245. Plus \$215,947 for attorneys and mediation. Total cost: \$1,216,191. One of the claimants was Bejo Seeds, who received \$215,000.

Of course, since there was no stream gage in the AG channel, we don't know what flood event 2001 - perhaps extrapolate from the upstream AG gage?

I've attached what I wrote up as a rough estimate of potential costs of the 20-year event in Zone 1/1A - the best I could do with the time and data available (due date is today). Obviously, could use better local estimates of potential flood repair costs to houses vs. businesses vs. mobile homes. Don't know if it'll be helpful for what you're working on for the IRWM, but maybe there's something you could use. Tom Zehnder gave me the \$5,000,000 estimate for the Sanitation Plant. Of course, unless there's a levee breach/failure, flooding would most likely be confined to the south side since south levee is kept lower, but I used worst case scenario of flooding on both sides.

(Jeff - can you please forward to Diana Haines?)

Julie Thomas
South County Watershed Coordinator
Coastal San Luis Resource Conservation District
545 Main St, Suite B-1, Morro Bay CA 93442
Phone: 805-471-9479
Fax: 805-772-4398

Website: <http://www.coastalrcd.org/>



Estimating damage from 20-year flood.doc

Question 18: Flood repair costs; pre- and post-project anticipated flood damage repair costs and flood recurrence interval used in the determination.

Estimating flood damage costs: 20-year event

The County of San Luis Obispo does not have projections available on potential costs of flood repairs for landowners adjacent to the Arroyo Grande Creek flood control channel, so other methods of estimating potential costs were used.

Defining the 20-year floodplain: In 2006, a Proposition 218 ballot measure was passed establishing a zone of special benefit in which landowners within the 20-year floodplain received additional assessments to finance Arroyo Grande Creek flood channel maintenance. The SLO County's Assessment Engineer defined this zone of special benefit by modeling those areas that would be flooded in a 20-year event:

“The boundary of the Zones was determined through the use of the Hydraulic Model prepared by Swanson Hydrology and Geomorphology as part of their work for the Coastal San Luis Resource Conservation District. The water surface elevations generated by the hydraulic model at each of the cross sections in the hydraulic model were intersected with the ground surface to establish the worst case inundation level should the channel's levee be breached or damaged. The 20 year flood recurrence was used for the purpose of defining benefit for this additional assessment.”

(From the “Assessment Engineers Report for Added Special Benefit” prepared by Cannon Associates for San Luis Obispo County Flood Control and Water Conservation District, Zone 1/1A, March 2006.) Swanson Hydrology & Geomorphology used U.S. Army Corps of Engineer data (USACOE, 1999) from a HEC-1 model to create a updated HEC-HMS model in order to generate input hydrographs for an unsteady state HEC-RAS hydraulic model. The unsteady state hydraulic model provided levee overtop volumes to evaluate the extent and depth of flooding for the different flood protection alternatives described in the 2006 “Arroyo Grande Creek Erosion, Sedimentation and Flooding Alternatives Study”. The Army Corps of Engineer HEC-1 model (and consequently the SH+G HEC-HMS model), assumed that Lopez Dam, upstream of the AG Creek flood control channel, was full and spilling, thereby providing a conservative, worst-case flooding scenario. Because Lopez Dam is managed for water supply and not flood control, spilling is not managed in any formal way.

Flooding cost estimates: To estimate costs for flooding repairs and replacement of losses, the following sources were used:

- The 2006 Alternatives Study used an estimate of \$8000 per acre for losses to agricultural land.
- The government website www.floodsmart.gov provides a national average flood insurance claim payout for flood losses as \$46,168 per claim. (<http://www.floodsmart.gov/floodsmart/pages/statistics.jsp>). This average of \$46,168 per

claim is applied to all homes, mobile homes, and businesses in Zone 1/1A for purposes of developing an estimate of AG Creek flood costs in the table below.

Assuming a scenario in which there is flooding of the entire Prop 218 area on both the north and south sides of the levee, estimated costs of damage in the 20-year event are shown below.

**Estimated cost of flood repairs for Prop 218 Zone of Special Benefit for
Arroyo Grande Creek flood control channel**

	Unit	No.	Est. repair / loss compensation	Cost of repairs / losses	Notes
Agricultural land (acres)	acres	1760	\$8,000	\$14,080,000	Unit cost based on 2006 Arroyo Grande Creek "Alternatives Study"
Single family residence	home	137	\$46,168	\$6,325,016	Unit cost based on national average given on website www.floodsmart.gov
Mobile homes (in 4 parks)	home	400	\$46,168	\$18,467,200	"
Manufacturing / residential / commercial	business	120	\$46,168	\$5,540,160	"
South San Luis Sanitation District	facility	1	\$5,000,000	\$5,000,000	Estimate based on personal conversation with San. District engineer
Oceano Airport	facility	1	\$500,000	\$500,000	Rough estimate of costs of repair of damaged airplanes and runways
TOTAL:				\$49,912,376	

Based on the assumptions shown in the table above, repairs during a 20-year flood event would total nearly \$50,000,000. Note that this estimate does not include costs of any damages to the Union Pacific Railroad tracks, which lie on both sides of the levee, crossing the channel via a bridge west of 22nd Street.

An estimate of costs of flooding of a portion of the 20-year floodplain can be based on costs to the County of the 2001 flood event, in which the south levee was breached west of the Union Pacific Railroad Bridge, in the lower portion of the flood control channel (see Figures 3 and 4 in Attachment A of Clark grant proposal). By breaching downstream of the railroad tracks, on the south side of the levee, in the lower reach of the flood channel, flooding was largely confined to the westernmost agricultural land in the Cienega Valley (rather than all of the ag land in the Prop 218 zone), plus one residence and a few businesses. The Sanitation Plant, the Airport, all of the mobile home parks, and most of the residences are on the north side of the levee, and were unaffected by the 2001 flood. Ultimately, the 2001 flood led to 16 claims against SLO County, resulting in a settlement of \$1,000,245, plus \$215,947 in attorney and mediation costs, for a total cost to taxpayers of \$1,216,191. Of this amount, the reimbursement to one business alone was \$215,000. Because the AG Creek flood control channel did not have a stream gage installed in 2001 (gages are scheduled for installation by SLO County Public Works in early 2008), the flood recurrence interval of the 2001 event is unknown.

Exhibit 3M

SAN LUIS OBISPO COUNTY
DAM and LEVEE FAILURE EVACUATION PLAN
EMERGENCY RESPONSE PLAN

STANDARD OPERATING PROCEDURE

FOR

**SAN LUIS OBISPO COUNTY
PUBLIC WORKS DEPARTMENT**

**ARROYO GRANDE CREEK LEVEE FAILURE
EMERGENCY RESPONSE PLAN**

(AGCLFERP)

ORIGINAL
MARCH 2009

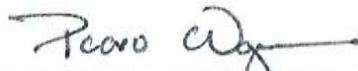
(page intentionally left blank)

AUTHENTICATION

This Standard Operating Procedure has been approved and is hereby incorporated as a department/agency/jurisdiction procedure.

Signed and Accepted:

OK
G. Lator



PAAVO OGREN, Director of Public Works

3/4/09

Date

PREFACE

This SOP is a component of the San Luis Obispo County Dam and Levee Failure Evacuation Plan. Detailed preparedness measures and emergency procedures concerning the operation of the Arroyo Grande Creek Levees by the Public Works Department are included herein. The San Luis Obispo County Dam and Levee Failure Evacuation Plan describes the overall County emergency organization and response, including Implementing Instructions to be used by the County Command group and other key officials at the County Public Works Department Operations Center (PWDOC) and the County Emergency Operations Center (EOC), in directing the emergency response activities.

REVISIONS

DESCRIPTION	DATE
Original Document	12/2008
Complete Revision	03/2009
Annual Revision (Describe Salient Changes)	

DISTRIBUTION

COPY	QUANTITY	LOCATION	DATE
Original	1	PWD Office File	
Working Copy	1	PWD Office File	
EOC	1	Agency Binder	
	1	Command Room File Cabinet	
Sanitized Version	1	SLO County Library (CD)	
	1	Cal Poly Library (CD)	
Dept./Agency	1	Public Works, Utilities Div. Manager	
	2	Public Works DOC	
	1	Public Works, Hyd. Ops. Administrator	
	1	Lopez Water Treatment Plant	
	1	Public Works Section 4 Yard	
	1	Public Works, Road Division Manager	
	1	Sherriff's Dept	
	1	County Fire	
	1	CHP	
	1	County OES	
	1	Public Health	
	1	PH Environmental Health	
	1	American Red Cross	
	1	City of Arroyo Grande	
	1	Oceano CSD	
	1	South County Sanitation District	

DUPLICATION QUANTITY [21]

TABLE OF CONTENTS

PART ONE – OVERVIEW	1
1. INTRODUCTION.....	1
1.1 PURPOSE	1
1.2 OBJECTIVES	1
2. BACKGROUND.....	1
3. SCOPE.....	2
4. RESPONSIBILITIES	2
5. CONCEPT OF OPERATIONS	2
6. COMMUNICATIONS.....	3
7. EMERGENCY FACILITIES AND EQUIPMENT	3
7.1 FACILITIES.....	3
7.2 EQUIPMENT AND SUPPLIES	3
8. EMERGENCY WORKER SAFETY	3
9. REQUESTS FOR FLOOD EMERGENCY ASSISTANCE.....	4
10. EXERCISES AND DRILLS	4
11. PROCEDURE MAINTENANCE	4
PART TWO - CHECKLISTS.....	5
CHECKLIST 1: Storm Flow Stage Determination	7
CHECKLIST 2: Pre-Storm Flow Stage Response	9
CHECKLIST 3: FULL STORM FLOW STAGE RESPONSE.....	11
CHECKLIST 4: PRE-STORM FLOW INSPECTION	15
CHECKLIST 4: PRE-STORM FLOW INSPECTION	15
CHECKLIST 5: FULL-STORM FLOW INSPECTION.....	17
CHECKLIST 6: POST-STORM FLOW INSPECTION.....	19

FIGURES	21
FIGURE 1-1: Storm Flow Stages at Valley Road Bridge	23
FIGURE 1-2: Storm Flow Stages at 22 nd Street Bridge	24
FIGURE 1-3: Storm Flow Stages at Low Point on South Levee – Station 9068	25
FIGURE 1-4: Stream Gauge Location Map	26
FIGURE 2-1: Patrol Areas Location Map	27
FIGURE 2-2: Patrol Area 1 Map	28
FIGURE 2-3: Patrol Area 2 Map	29
FIGURE 2-4: Patrol Area 3 Map	30
FIGURE 3-1: Flood Evacuation Zone Map	31
TABLES	32
TABLE 1-1: FULL-STORM FLOW STAGE CREEK LEVELS	33
TABLE 1-2: POST-STORM FLOW STAGE CREEK LEVEL	33
TABLE 1-3: STAGE GAUGE LOG	34
TABLE 6-1: FLOOD DAMAGE LOG	35
PART THREE – APPENDICES	37
Appendix 1: Procedural Memorandum AD-18, Storm Emergency Operations	39
Appendix 2: Emergency Call List	47
Appendix 3: Anticipated Rates of Increase in Water Surface Elevation	55

PART ONE – OVERVIEW

1. INTRODUCTION

1.1 PURPOSE

This Standard Operating Procedure (SOP) details the specific standard operating procedures to be followed by the Department of Public Works in carrying out the San Luis Obispo County Dam and Levee Failure Evacuation Plan for the Arroyo Grande Creek Levees.

1.2 OBJECTIVES

The objectives of this plan are:

- Provide a background of the threat posed by the Arroyo Grande Creek Levees
- Provide procedures for operation and maintenance of Arroyo Grande Creek Levees and facilities during periods of potential flood emergency.
- Provide guidelines that Public Works may use to predict a levee failure
- Define and explain initial emergency responses to a potential or actual levee failure
- Establish guidelines under which Public Works can operate upon determination of a potential or actual failure of the levees

2. BACKGROUND

The Arroyo Grande Flood Control Project was constructed to convey the design capacity of 7,500 cubic feet per second (cfs) with 2 feet of freeboard. The originally constructed channel was believed to provide flood protection from a storm with over a 50 year recurrence interval.

Due to challenges in maintaining the channel, such as inadequate funding and regulatory requirements, the channel has lost significant capacity since it was originally constructed in 1961. Although the maintenance efforts are improving since assessments were approved in July 2006 to pay for maintenance on the channel, the existing capacity of the channel is estimated to be 2,500 cfs, a reduction in capacity of over 75%. It is estimated that the channels can provide flood protection from a storm with only a 4.6 year recurrence interval. This means that the channel has the probability to overtop once every 4.6 years¹.

¹ Arroyo Grande Creek Erosion, Sedimentation and Flooding Alternatives Study, Swanson Hydrology & Geomorphology, January 4, 2006.

The local threat of flood related damage due to a channel overtopping or levee failure is primarily confined to low-lying areas less than 50 feet above mean sea level that are immediately adjacent to the Arroyo Grande Creek levees. If the gradient is shallow, flood waters can spread over a large area. The primary effects of a flood can be destruction and damage to low-lying areas.

The effects of a flood can range from insignificant damage to heavy damage with fatalities. The northern levee protects several residential developments, as well as the regional wastewater treatment plant that services the communities of Arroyo Grande, Oceano, and Grover Beach and the Oceano Airport. If the north levee is overtopped or breached, risk to human life will be a threat. The southern levee protects hundreds of acres of farmland and several residences.

3. SCOPE

This SOP is to be used in conjunction with the Department's Procedural Memorandum AD-18 - Storm Emergency Operations (Appendix 1).

4. RESPONSIBILITIES

Declaration of a storm event and/or storm emergency conditions will be in accordance with AD-18 (Storm Emergency Operations). In case of emergency, please refer to the emergency call list for the Department of Public Works (Appendix 2).

The responsible operating personnel (Utilities Division Manager/Roads Maintenance Manager or designee(s)) will ascertain when these conditions are likely to occur by monitoring National Oceanic and Atmospheric Administration (NOAA) and local weather forecasts during storm periods.

Utilities Operations or Road Maintenance crews will be responsible for performing facility inspections, operation and maintenance.

5. CONCEPT OF OPERATIONS

Procedures for operation and maintenance of Arroyo Grande Creek Levees and facilities during periods of expected flood emergency were developed for three storm stages:

1. Pre-storm flow
2. Full-storm flow
3. Post-storm flow

Checklists were developed for Public Works' required response to each storm stage and are included in Part 2 of this document.

Guidelines for the responsible operating personnel (Utilities Division Manager/Roads Maintenance Manager or designee(s)) to determine the storm stage or potential flood emergency are included in Checklist 1.

Pre-storm flow and full-storm flow stage response guidelines are included in Checklists 2 and 3, respectively.

If a storm emergency is determined by the Utilities Division Manager/Roads Maintenance Manager, then 2 person mobile patrols (Utilities Operations or Roads Maintenance personnel) will be assigned to specific sections of the levee system. Patrols will perform inspections as necessary. Patrol checklists for each storm stage are also included in Part 2 of this document.

6. COMMUNICATIONS

Alert alarms from existing stream gauges at Valley Road and 22nd Street Bridges will notify key personnel of when high flows are occurring in Arroyo Grande Creek Channel and/or Los Berros Diversion.

Utilities Division Manager/Roads Maintenance Manager will remain in contact with assigned patrols via telephone and or radio. Patrols may report results of levee system inspection to the Public Works Department Operation Center (PWDOC), if available.

7. EMERGENCY FACILITIES AND EQUIPMENT

7.1 FACILITIES

If the Full-Storm flow stage is occurring and there is a potential flood emergency, the PWDOC will be opened and located at the County Government Center (Old Courthouse), Room 207.

7.2 EQUIPMENT AND SUPPLIES

Materials and equipment that are necessary to perform operation and maintenance on the channel system during a flood emergency may be obtained from the Section 4 yard.

8. EMERGENCY WORKER SAFETY

All field personnel are to exercise extreme caution when working in the vicinity of the flood control channel and levee system during a storm event and are to avoid any situation which may place county personnel and/or equipment in danger. All field personnel should follow Occupational Safety and Health Administration (OSHA) regulations for storm emergency operations.

Personnel performing inspections on the levee tops during storm events should only drive on the levee tops if they are in a 4-wheel drive vehicle and conditions are safe.

9. REQUESTS FOR FLOOD EMERGENCY ASSISTANCE

When it is evident that local agency manpower, equipment and/or funds will be exhausted and other local resources are insufficient to cope with the situation, then assistance may be requested from the State Department of Water Resources per AD-18.

If it appears that the particular flood situation cannot be controlled with either local or state resources, then DWR will request federal assistance. The director of DWR will coordinate the activation of Public Law 84-99 for emergency assistance from the U.S. Army Corps of Engineers.

10. EXERCISES AND DRILLS

Exercises and drills will be conducted annually or whenever procedures are revised. Applicable agencies will be included in all exercises and drills.

11. PROCEDURE MAINTENANCE

This procedure will be maintained by the Utilities Division Manager or designee(s). SOP will be reviewed annually and after any flood emergency to evaluate SOP effectiveness. Lessons learned during a flood emergency will be documented and incorporated into the annual revision of the SOP.

PART TWO - CHECKLISTS

- CHECKLIST 1: Determination of Storm Flow Stage
- CHECKLIST 2: Pre-Storm Flow Stage Response
- CHECKLIST 3: Full-Storm Flow Stage Response
- CHECKLIST 4: Pre-Storm Flow Inspection
- CHECKLIST 5: Full-Storm Flow Inspection
- CHECKLIST 6: Post-Storm Flow Inspection

(page intentionally left blank)

CHECKLIST 1: Storm Flow Stage Determination

PURPOSE: The purpose of this checklist is to provide a list of steps to assist the Utilities Division Manager in determining the storm flow stage.

1. FULL-STORM FLOW STAGE DETERMINATION

- _____ 1.1 National Weather Service forecasts heavy rainfall of more than 0.3 inches per hour or more than 2 inches within a 24-hour period
- _____ 1.2 Receive "high flow" notification from mobile patrols, automatic stream gauge alarm system, or other source.
- _____ 1.3 Confirm/verify flow at specific gauging station location in each channel reaches or exceeds the levels indicated in Table 1-1 and illustrated on Figures 1-1, 1-2, and/or Figure 1-3.
- _____ 1.4 Log confirmed flows on Table 1-3.

CONFIRM/VERIFY USING COUNTY WEBSITE STAGE READING:

Go to www.SLOCountyWater.org

1. From the orange menu bar at the top of the page, navigate to:
Real-Time Water Data → Stream Flow
2. From the "Station" pull-down menu (mid-page), select:
"22nd Street Bridge" or "Valley Road"

(Alternately, click on the appropriate green icon on map.)

3. From this webpage:

The "Stream Stage Hydrograph" (stage plot) shows the height of the water over time. The County website offers plots with 3-, 5-, 7-, and 14-day intervals. (The default view is the 14-day interval.)

The "Stream Stage Data" (data table) presents tabular stage data, logged every 15 minutes and when the stage changes by 0.05 feet or more.

Notes:

The "Stream Stage Hydrograph" and "Stream Stage Data" web pages are updated every 10 minutes.

Be sure to check the date and time the page or chart was updated to ensure that the presented stage data is current.

CONFIRM/VERIFY AT STAFF GAUGE:

1. To view the staff gauge readings:

Los Berros staff gauge is located on the northerly side of the southwestern bridge pier on the downstream side of the bridge. Refer to photo below and Figure 1-4.

Arroyo Grande staff gauge is located on the southerly side of the middle bridge bent on the upstream side of the bridge. Refer to the photo below and Figure 1-4.



Valley Road Staff Gauge
(looking South)



22nd Street Bridge
(looking North)

2. To view the electronic stage gauge reading, unlock lid (Southco key, # CH751) to instrument housing and open lid on data logger
3. Press the "On/Off" button once.
4. Startup screen disappears and "Stage..." appears
5. Press the "Enter" button to measure (and display) the current stage

Notes:

Unit will automatically turn off after 5 minutes of non-use.

2. POST-STORM FLOW STAGE DETERMINATION

- ____ 2.1 National Weather Service no longer forecasts heavy rainfall
- ____ 2.2 Confirm/verify that flow at the 22nd Street Bridge stream gauge is under the post storm flow stage, as indicated in Table 1-2.

CHECKLIST 2: Pre-Storm Flow Stage Response

PURPOSE: The purpose of this checklist is to provide a list of steps to assist the Utilities Division Manager/Road Maintenance Manager in responding to the pre-storm flow stage.

1. EXISTING CONDITIONS

- _____ 1.1 Monitor NOAA and local weather forecasts during storm periods
- _____ 1.2 National Weather Service forecasts heavy rainfall of more than 0.3 inches per hour or more than 2 inches within a 24-hour period

2. INITIAL ACTIONS

2.1 Notifications

- _____ 2.1.1 Alert Director or his designee and place on emergency standby to open PW DOC.
- _____ 2.1.2 Alert **OES (781-5011)** and place on emergency standby.
- _____ 2.1.3 Alert Public Works Environmental Programs Division per Procedural Memorandum AD-18 (Appendix 1).
- _____ 2.1.4 Alert emergency crews (Utilities Operations/Road Maintenance personnel) and place on emergency standby for possible activation under the Full-Storm Flow Stage.

2.2 Actions

- _____ 2.2.1 Assign 2-person mobile patrols (Road Maintenance or Utilities Operations personnel) to inspect three (3) areas of the channel system shown in Figures 2-1, 2-2, 2-3, and 2-4. Note: Patrols should follow steps in Checklist #4.

Patrol Area 1 assigned to: _____

Patrol Area 2 assigned to: _____

Patrol Area 3 assigned to: _____

- _____ 2.2.2 Follow up with patrols to get a verbal report on the condition of the facilities and if there is a limited area emergency that needs correction availability of equipment and supplies.
- _____ 2.2.3 Coordinate necessary repair and maintenance to correct any limited area emergency that prevents proper operation of the facilities; see steps 3 and 4 below

3. GENERAL EMERGENCY

If storm and/or limited area emergencies escalate to create hazardous conditions threatening channel and levee system integrity, initiate Checklist 3: Full Storm Flow Stage Response.

4. POST STORM FLOW ACTIONS

- _____ 4.1 In accordance with Checklist 1 (Post-Storm Flow Stage Determination), confirm/verify flow at the stream gauge at the 22nd Street Bridge is under the post storm flow stage
- _____ 4.2 Notify Director that storm flows have ceased and that major operations effort has been completed.
- _____ 4.3 Notify **OES (781-5011)** that storm flows have ceased and end emergency standby
- _____ 4.4 Notify Public Works emergency crews that storm flows have ceased and end emergency standby
- _____ 4.5 Follow-up with the Public Works Environmental staff regarding any repairs or maintenance activities to determine if any mitigation is necessary
- _____ 4.6 Document operations and maintenance efforts during storm event

CHECKLIST 3: FULL STORM FLOW STAGE RESPONSE

PURPOSE: The purpose of this checklist is to provide a list of steps to assist the Utilities Division Manager/Road Maintenance Manager in responding to the full-storm flow stage.

1. EXISTING CONDITIONS

- _____ 1.1 National Weather Service forecasts heavy rainfall of more than 0.3 inches per hour or more than 2 inches within a 24-hour period
- _____ 1.2 Receive "high flow" notification from mobile patrols, automatic stream gauge alarm system, or other source.
- _____ 1.3 Confirm/verify flow at specific gauging station location in each channel reaches or exceeds specified thresholds
 - _____ 1.3.1 Complete Checklist 1: Determination of Storm Flow Stage

2. INITIAL ACTIONS

2.1 Notification

- _____ 2.1.1 Alert Director or his designee to open PW DOC.
- _____ 2.1.2 Alert **Sheriff's Watch Commander** at **781-4553**. Request that Watch Commander alert OES and place on emergency standby for possible activation of the Emergency Alert System (EAS) per Attachment No. 10 of the County Dam and Levee Failure Evacuation Plan
- _____ 2.1.3 Alert Public Works Environmental Programs Division per Procedural Memorandum AD-18 (Appendix 1).
- _____ 2.1.4 Alert Public Works emergency crews (Utilities Operations/Road Maintenance personnel) for activation under the Full-Storm Flow Stage. Emergency Call List is included in Appendix 2.
- _____ 2.1.5 Alert **South County Sanitation District** at **489-6666**. After hours staff contact information is included in Appendix 2.
- _____ 2.1.6 Alert **County Environmental Health Services** at **781-5500**.

2.2 Actions

- _____ 2.2.1 Verify Lopez Dam releases have been shut off.
- _____ 2.2.2 Continually monitor rainfall and creek levels per guidelines in Checklist 1, and record creek levels in Table 1-3. Rates of

increase of water surface elevation for each channel for varying rainfall intensities are included in Appendix 3 to assist with determining how much time it there is before an evacuation of the flood zone is required.

_____ 2.2.3 Set up a field command post that is nearby but outside of the flood area, as necessary. If Public Works does not have the resources to staff the command post, alert **OES (781-5011)** and request assistance.

_____ 2.2.4 Assign 2-person mobile patrols (Road Maintenance or Utilities Operations personnel) to inspect three (3) areas of the channel shown in Figures 2-1, 2-2, 2-3 and 2-4. Note: Patrols should follow steps in Checklist #5.

Patrol Area 1 assigned to: _____

Patrol Area 2 assigned to: _____

Patrol Area 3 assigned to: _____

_____ 2.2.5 Follow up with patrols to get a verbal report on the condition of the facilities; patrols should report if there is a limited area emergency that needs correction

_____ 2.2.6 Coordinate necessary repair and maintenance to correct any limited area emergency that prevents proper operation of the facilities; see steps 3 and 4 below

****Note: If time permits, prior to conducting any repair or maintenance to the levees or within the channel itself, the Public Works Environmental staff should be contacted per Procedural Memorandum AD-18 (Appendix 1).***

3. EMINENT LEVEE FAILURE ACTIONS

3.1 Notification

_____ 3.1.1 Alert Director or his designee and recommend that **Watch Commander (781-4553)** be notified that a levee failure is eminent and recommend activation of the Emergency Alert System (EAS) per the County Dam and Levee Failure Evacuation Plan. Describe specific areas to be evacuated per Figure 3-1: Flood Evacuation Zone Map.

- _____ 3.1.2 Alert responding Public Works emergency crews (Utilities Operations/Road Maintenance personnel) that levee failure is eminent and instruct them to remain at a safe observation distance from the channel system and outside of the Flood Evacuation Zone shown on Figure 3-1.

3.2 Initial Actions

- _____ 3.2.1 Obtain updated report from patrols on the condition of the facilities including location of levee failure and approximate extent and depth of flows outside channels:

Location of failure: _____

Extent of flow outside of channels: _____

Depth of flow outside of channels: _____

- _____ 3.2.2 Assign emergency crews to barricade off roads leading to flooded areas

4. POST STORM FLOW ACTIONS

- _____ 4.1 In accordance with Checklist 1 (Post-Storm Flow Stage Determination), confirm/verify flow at the stream gauge at the 22nd Street Bridge is under the post storm flow stage
- _____ 4.2 Notify Director that major operations efforts to mitigate the levee failure emergency have been completed and that storm flows have ceased
- _____ 4.3 Notify OES that major operations effort to mitigate general emergency has been completed and whether or not storm flows have ceased
- _____ 4.4 Notify Public Works emergency crews that storm flows have ceased and end emergency standby; may allow partial demobilization
- _____ 4.5 Assign 2-person mobile patrols to inspect facilities
- _____ 4.6 Follow-up with patrols to obtain report of all damaged flood control facilities or appurtenant structures
- _____ 4.7 Initiate temporary or permanent repair of damaged flood control facilities

- _____ 4.8 Follow-up with the Public Works Environmental staff regarding any repairs or maintenance activities to determine if any mitigation is necessary
- _____ 4.9 Follow-up with **County Environmental Health Services (781-5500)** so they may begin assessment of general health issues and authorize re-habitation.
- _____ 4.10 Document operations and maintenance efforts during general emergency; include photographs of storm damage that were taken by patrols during inspections and performed maintenance

CHECKLIST 4: PRE-STORM FLOW INSPECTION

PURPOSE: The purpose of this checklist is to provide a list of steps to assist the Utilities Division/Road Maintenance personnel in responding to the pre-storm flow stage.

1. ASSIGNMENT

_____ 1.1 Receive assignment to patrol/inspect channel and levee system

Patrol (name/title): _____

Assigned Patrol Area (circle one): 1 2 3

Report results of inspection to (name/title):

Phone number to report to: _____

***NOTE: Patrols should carry County identification if not traveling in a County vehicle.**

2. INSPECTION

_____ 2.1 Check that **channels are clear of excessive debris** (or natural barriers, such as live trees, beaver dams, etc.) that may cause reduction in channel capacity or endanger drainage structures and other facilities

Location of debris jam: _____

_____ 2.2 Check **side drain inlet gates are free of debris** and clear debris as necessary and feasible; check for proper operation and seating

Location of clogged/inoperable side drain inlet (flap gate): _____

Action taken to clear/repair side drain inlet (flap gate): _____

3. NOTIFICATION

- _____ 3.1 Provide verbal report back to responsible operating personnel (contact listed above)

4. INITIAL ACTIONS

- _____ 4.1 Check availability of equipment and supplies

5. FOLLOW-UP ACTIONS

- _____ 5.1 Submit this checklist when completed to responsible personnel

CHECKLIST 5: FULL-STORM FLOW INSPECTION

PURPOSE: The purpose of this checklist is to provide a list of steps to assist the Utilities Division/Road Maintenance personnel in responding to the full-storm flow stage.

1. ASSIGNMENT

_____ 1.1 Receive assignment to **continuously** patrol channel and levee system

Patrol (name/title): _____

Assigned Patrol Area (circle one): 1 2 3

Report results of inspection to (name/title):

Phone number to report to: _____

***NOTE: Patrols should carry County identification if not traveling in a County vehicle.**

2. INSPECTION

_____ 2.1 Check for wavewash, boils, seepage, cracks or sloughing on the banks and sides of the levees or any other conditions that may indicate that failure of the levee is imminent

Notes: _____

_____ 2.2 Check that **channels are clear of excessive debris** (or natural barriers, such as live trees, beaver dams, etc.) that may cause reduction in channel capacity or endanger drainage structures and other facilities

Location of debris jam: _____

- _____ 2.3 Check **side drain inlet gates are free of debris** and clear debris as necessary and feasible; check for proper operation and seating

Location of clogged/inoperable side drain inlet (flap gate): _____

Action taken to clear/repair side drain inlet (flap gate): _____

- _____ 2.4 Photograph all locations where damage is occurring or has occurred, where damage has been repaired, or where any unusual conditions have been encountered

3. NOTIFICATION

- _____ 3.1 Provide verbal report back to responsible operating personnel (contact listed above)

****Note: Patrolling personnel should maintain communications with the Public Works Department Operations Center (per AD-18) and report problem areas that are too large or time consuming to repair with the minimal amount of equipment and material carried on patrol vehicles.***

4. INITIAL ACTIONS

- _____ 4.1 Initiate full mobilization, including all necessary equipment, supplies and man power

****Note: All equipment, supplies and personnel not in the immediate area should have been alerted during the pre-storm flow stage and should be available at minimum delay should emergency conditions arise***

- _____ 4.2 Dislodge all major debris accumulations if channel capacity is reduced or structures endangered.

****Note: Any condition endangering any flood control structure should be corrected as soon as possible.***

5. FOLLOW-UP ACTIONS

- _____ 5.1 Submit this checklist and applicable photographs to responsible personnel

CHECKLIST 6: POST-STORM FLOW INSPECTION

PURPOSE: The purpose of this checklist is to provide a list of steps to assist the Utilities Division/Road Maintenance personnel in responding to the post-storm flow stage.

1. ASSIGNMENT

_____ 1.1 Receive assignment to patrol channel and levee system

Patrol (name/title): _____

Assigned Patrol Area (circle one): 1 2 3

Report results of inspection to (name/title):

Phone number to report to: _____

2. INSPECTION

_____ 2.1 Check for damaged flood control facilities in the channels or appurtenant structures, damage to public and private property and log in Table 6-1

_____ 2.2 Photograph all locations where damage has occurred

_____ 2.3 Check **side drain inlet gates are free of debris** and clear debris as necessary and feasible; check for proper operation and seating

Location of clogged/inoperable side drain inlet (flap gate): _____

Action taken to clear/repair side drain inlet (flap gate): _____

3. NOTIFICATION

_____ 3.1 Provide verbal report back to responsible operating personnel (contact listed above)

4. INITIAL ACTIONS

_____ 4.1 Initiate partial de-mobilization

****Note: Full demobilization should be delayed until the operations under this post-storm flow stage have been completed***

_____ 4.2 Initiate applicable temporary or permanent repair of damaged flood control facilities

****Note: Any condition endangering any flood control structure should be corrected as soon as possible.***

_____ 4.3 Inventory equipment and materials and make ready for subsequent stream flows

5. FOLLOW-UP ACTIONS

_____ 5.1 Submit this checklist with completed Table 6-1 and applicable photographs to responsible personnel

FIGURES

FIGURE 1-1: Storm Flow Stages at Valley Road Bridge

FIGURE 1-2: Storm Flow Stages at 22nd Street Bridge

FIGURE 1-3: Storm Flow Stages at Low Point on South Levee – Station 9068

FIGURE 1-4: Staff Gauge Location Map

FIGURE 2-1: Patrol Areas Location Map

FIGURE 2-2: Patrol Area 1 Map

FIGURE 2-3: Patrol Area 2 Map

FIGURE 2-4: Patrol Area 3 Map

FIGURE 3-1: Flood Evacuation Zone Map

(page intentionally left blank)

Figure 1-1: Storm Flow Stages at Valley Road Bridge

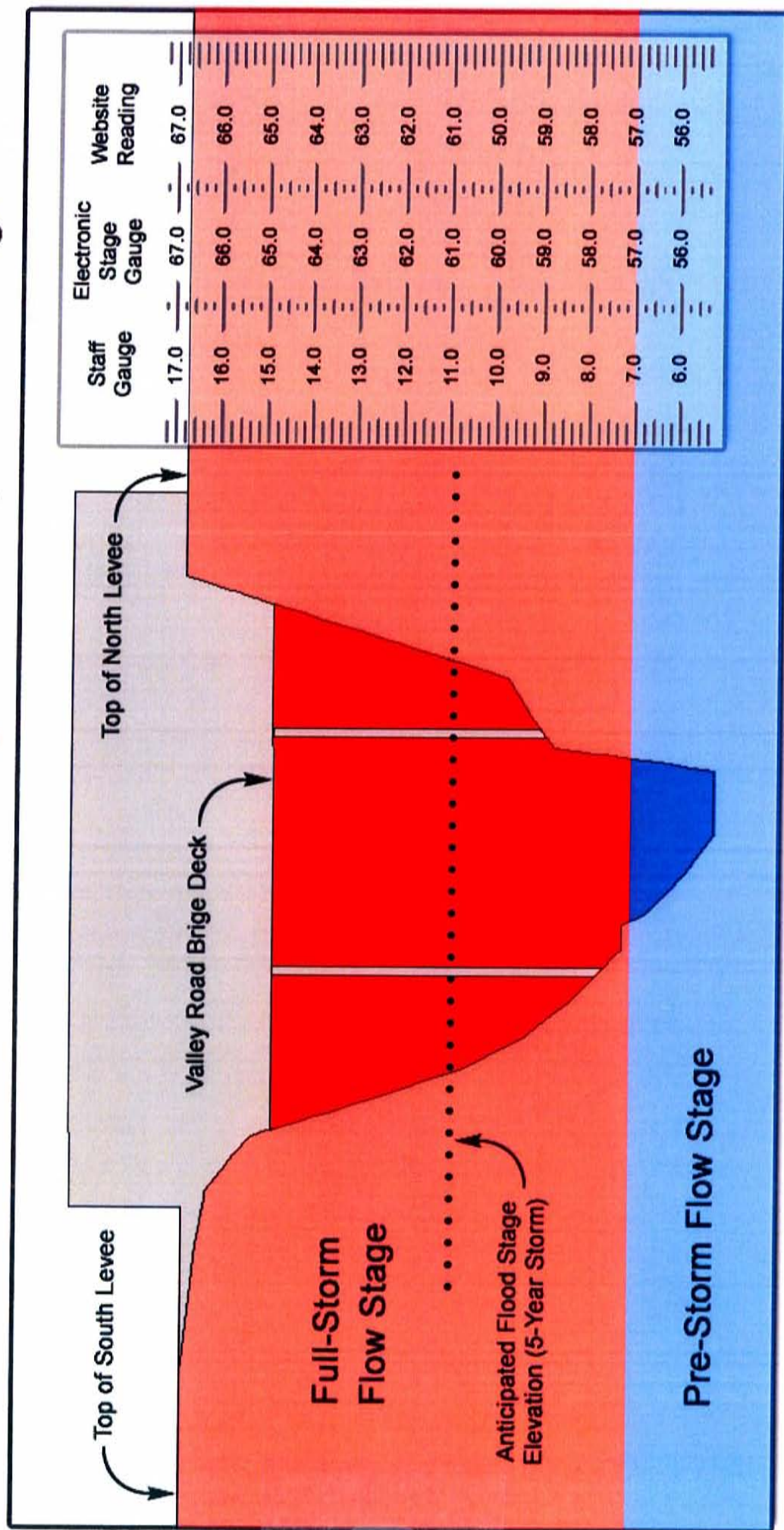


Figure 1-2: Storm Flow Stages at 22nd Street Bridge

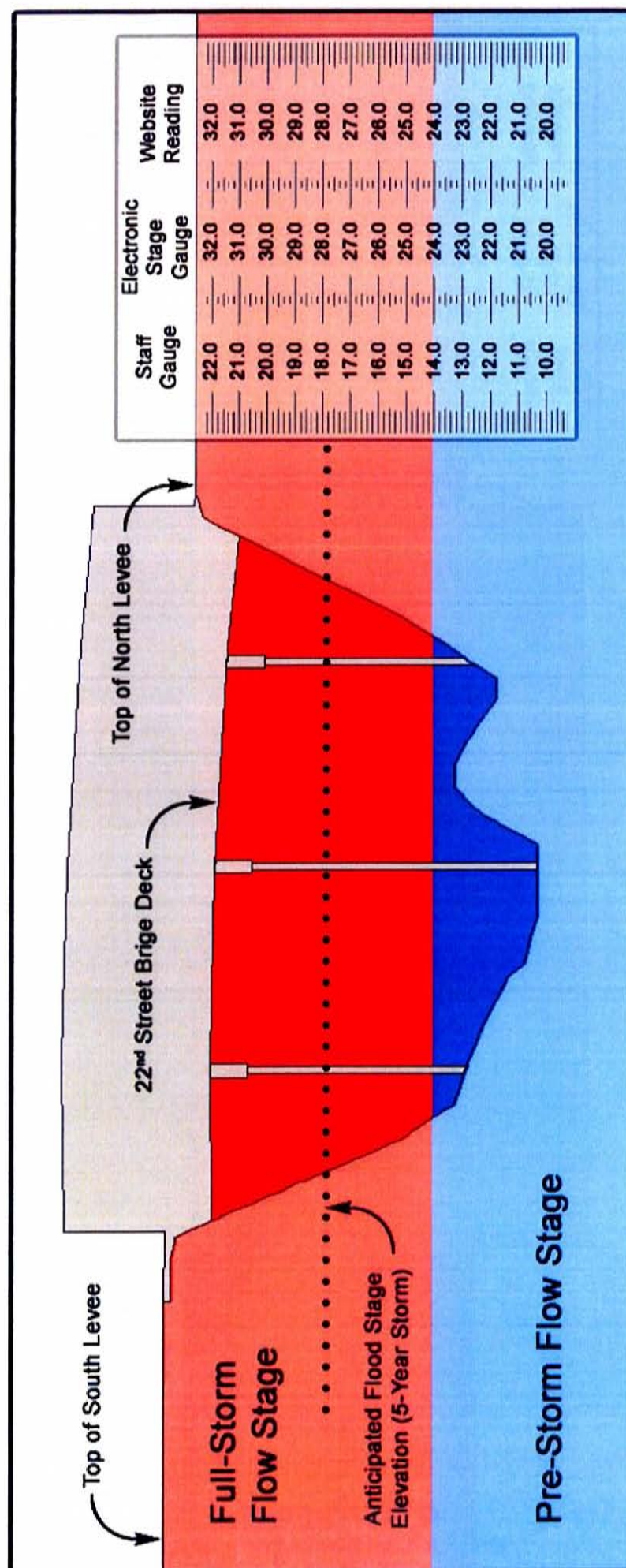
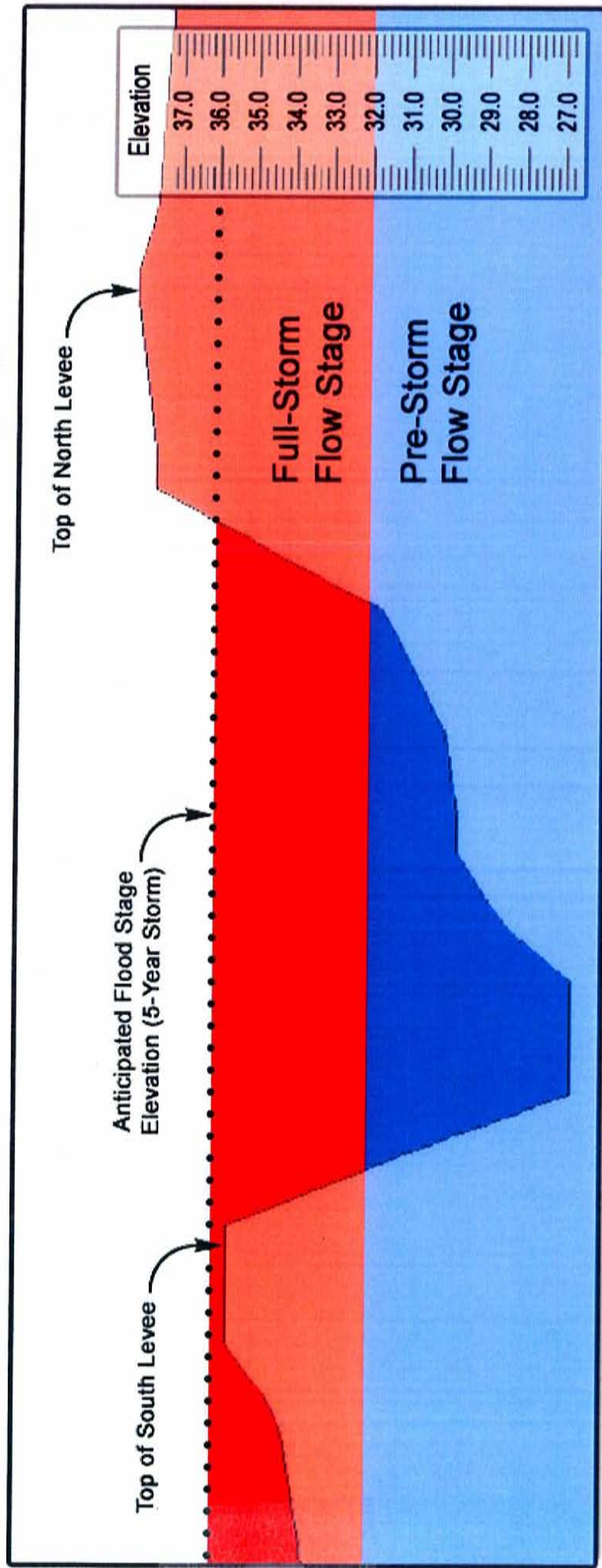
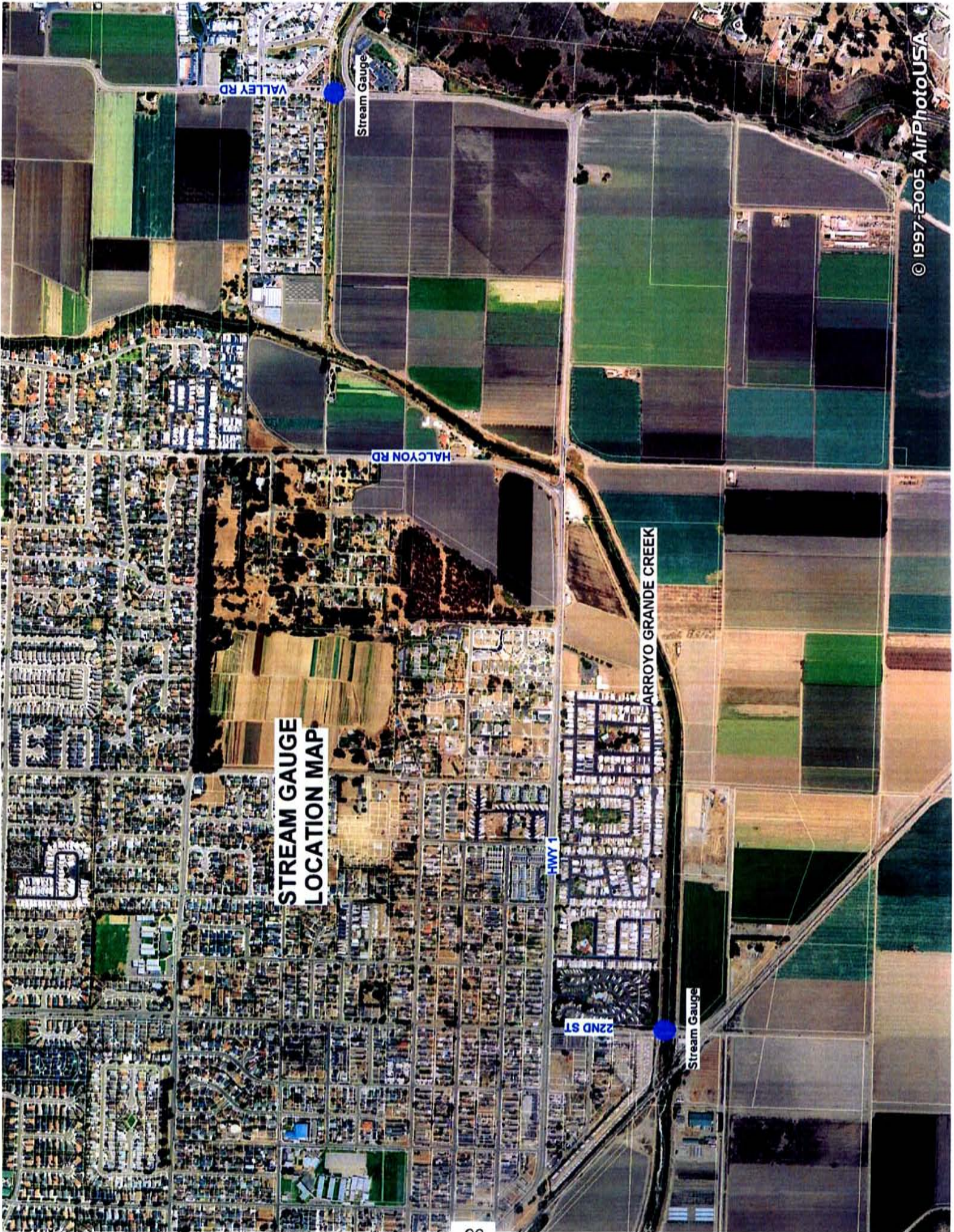


Figure 1-3: Storm Flow Stages at Low Point on South Levee
 Station 9068 - Patrol Area 2 - Rapp, George Property



**STREAM GAUGE
LOCATION MAP**



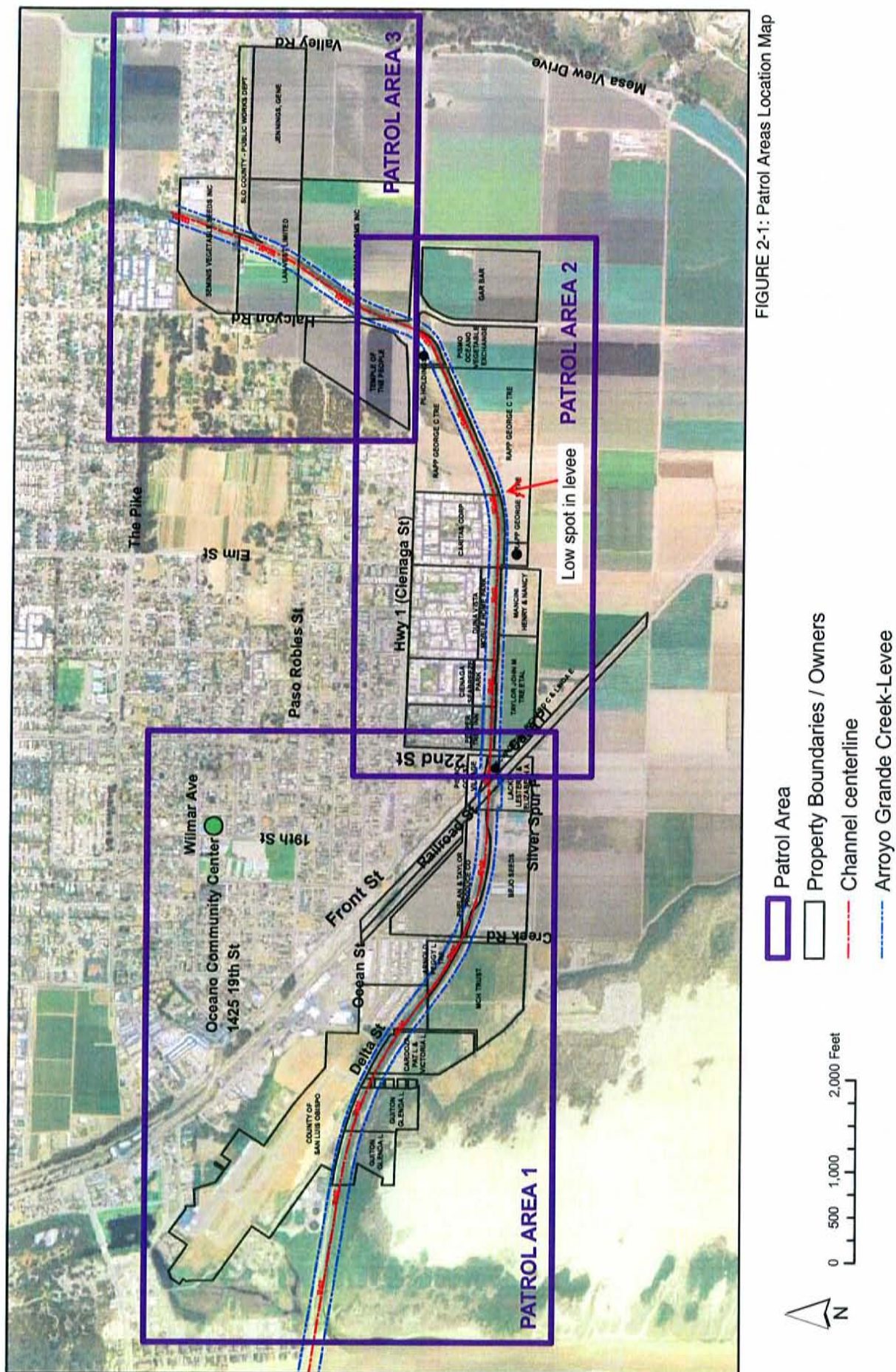


FIGURE 2-1: Patrol Areas Location Map

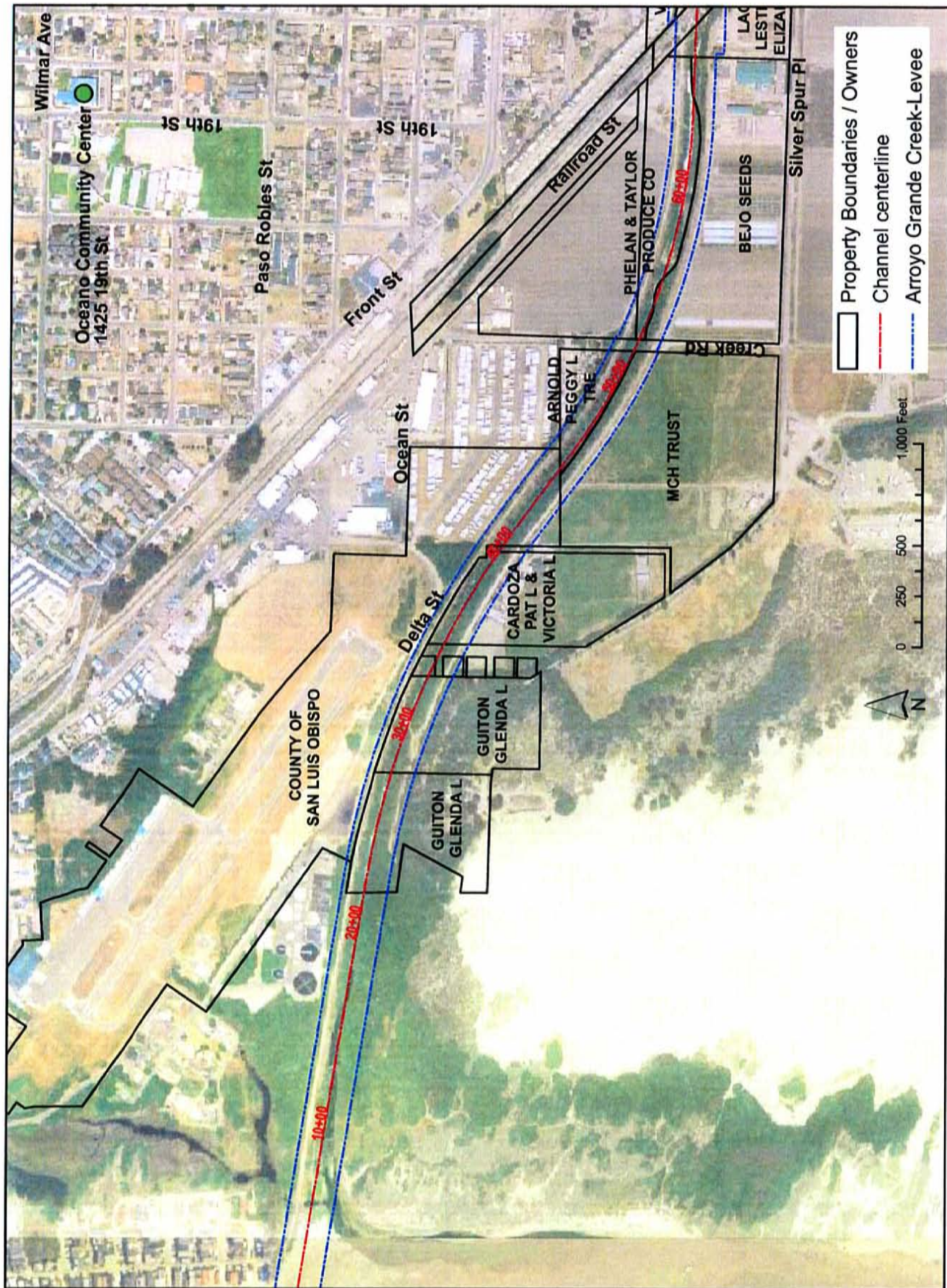


FIGURE 2-2: Patrol Area 1 Map

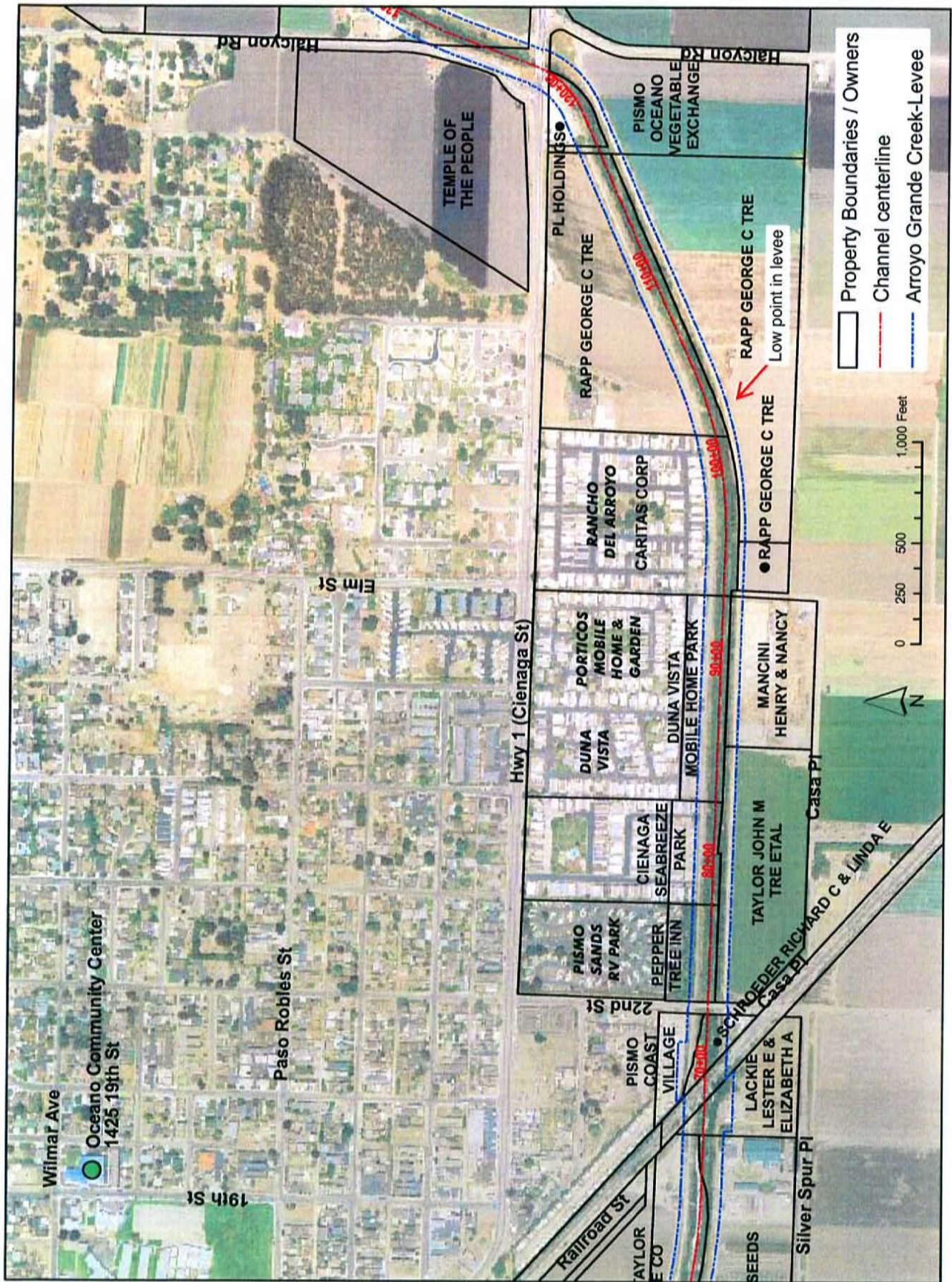


FIGURE 2-3: Patrol Area 2 Map

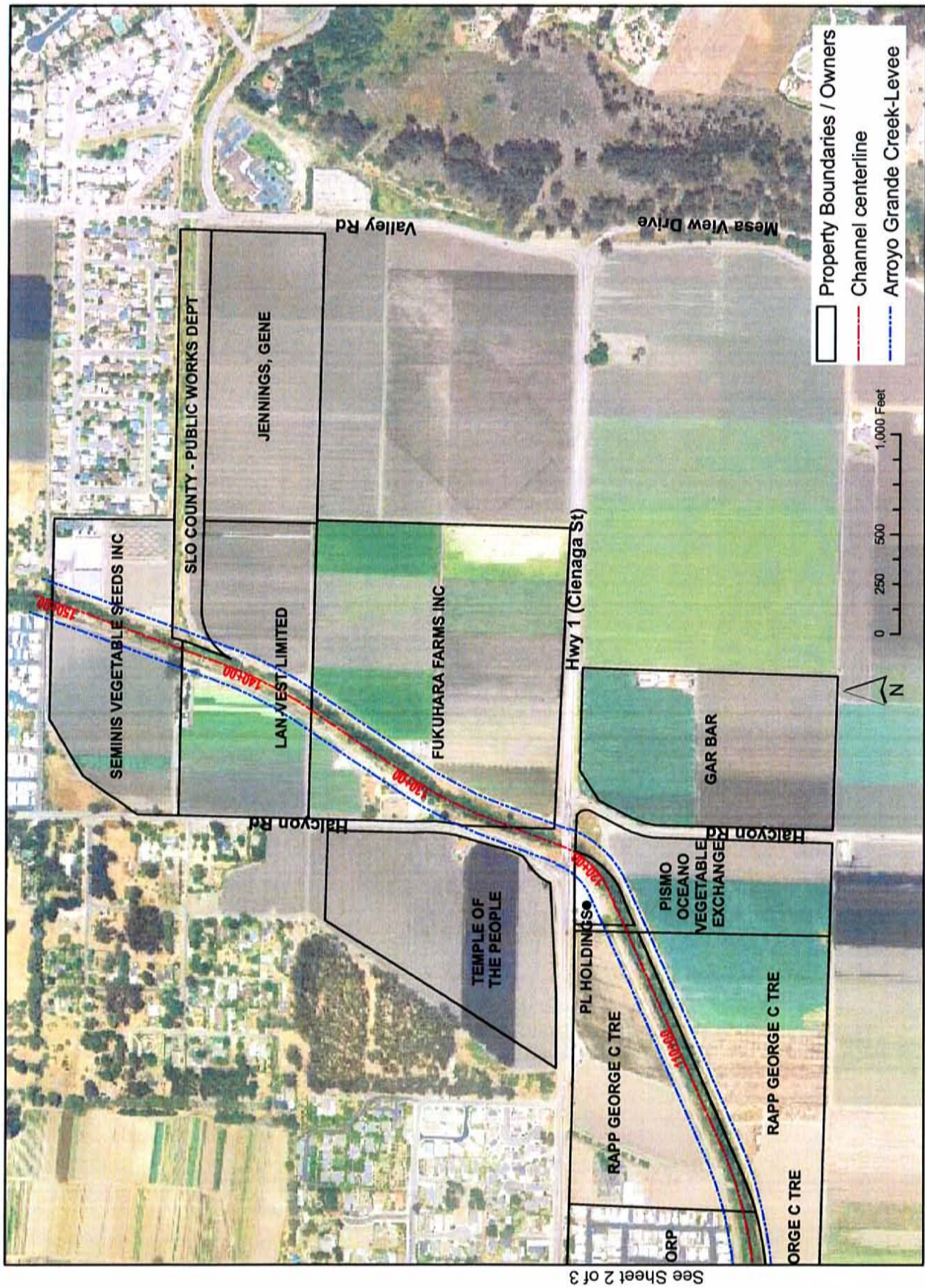


FIGURE 2-4: Patrol Area 3 Map

See Sheet 2 of 3

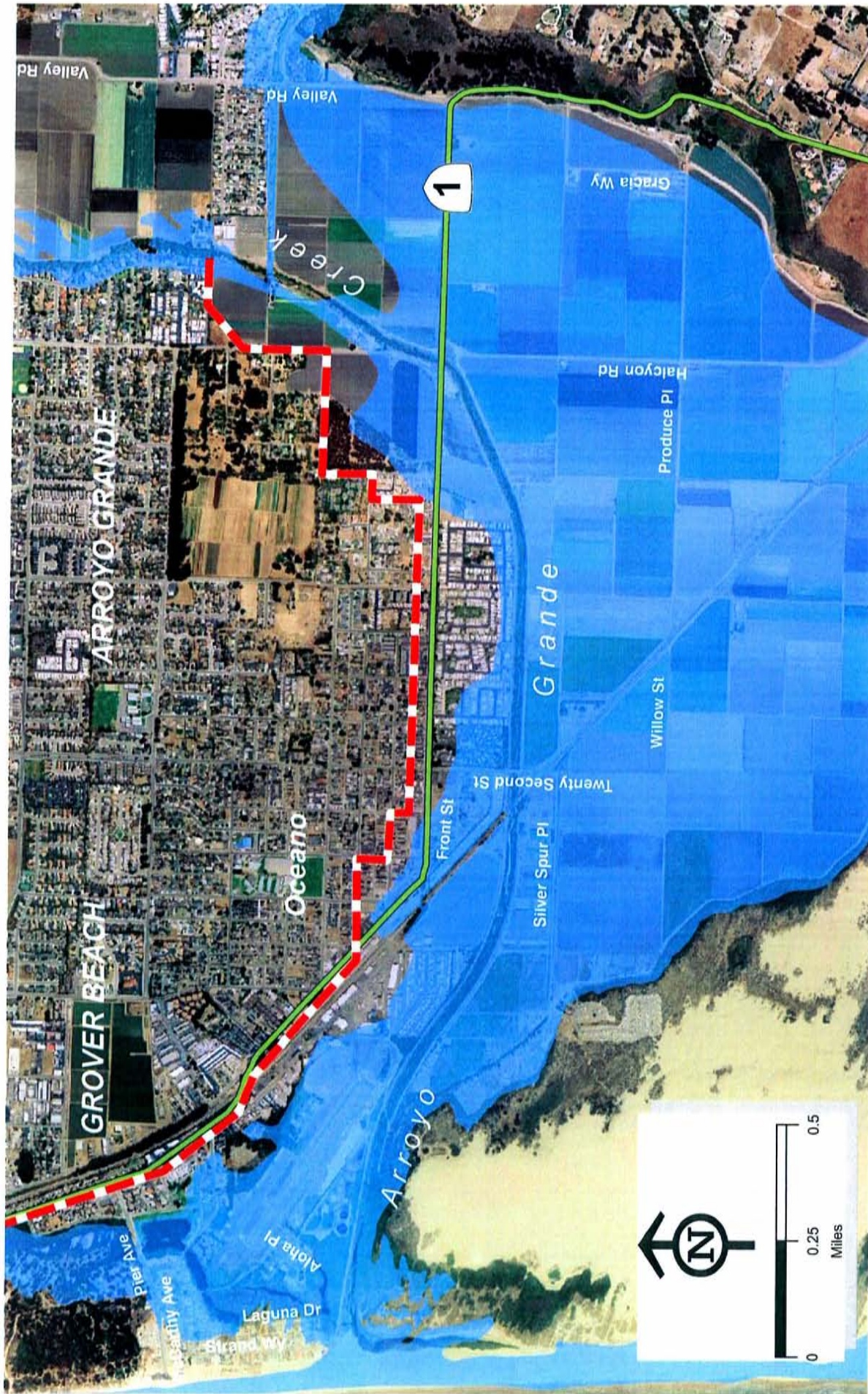


FIGURE 3-1: Flood Evacuation Zone

TABLES

TABLE 1-1:	FULL STORM FLOW CREEK LEVELS
TABLE 1-2:	POST STORM FLOW CREEK LEVELS
TABLE 1-3:	STAGE GAUGE LOG
TABLE 6-1:	FLOOD DAMAGE LOG

TABLE 1-1: FULL-STORM FLOW STAGE CREEK LEVELS

Creek Channel	Gauge Site	Full Storm Flow Stage			
		Staff Gauge Reading ¹ (feet, NAVD29)	Electronic Stage Gauge Reading ² (feet, NAVD29)	Website Reading ³ (feet)	
Los Berros	Valley Road	[=WSE-50.0]	7.0	[=WSE]	57.0
Arroyo Grande	22nd Street	[=WSE-10.0]	14.0	[=WSE]	24.0

NOTES:

¹ Staff gauge located in creek channel

² Stage gauge located in instrument enclosure, on bridge rail

³ Data located on website

TABLE 1-2: POST-STORM FLOW STAGE CREEK LEVEL

Creek Channel	Gauge Site	Post Storm Flow Stage			
		Staff Gauge Reading ¹ (feet, NAVD29)	Electronic Stage Gauge Reading ² (feet, NAVD29)	Website Reading ³ (feet)	
Arroyo Grande	22nd Street	[=WSE-10.0]	13.0	[=WSE]	23.0

NOTES:

¹ Staff gauge located in creek channel

² Stage gauge located in creek equipment enclosure, on bridge rail

³ Data located on website

TABLE 1-3: STAGE GAUGE LOG

Date	Time	Creek Channel	Gauge Site	Staff Gauge Reading by Inspection	Electronic Staff Gauge Reading	Website Reading
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			
		Los Berros	Valley Road			
		Arroyo Grande	22 nd Street			

TABLE 6-1: FLOOD DAMAGE LOG

Inspector: _____ Date: _____

Patrol Area (circle one): 1 2 3

Item	Location (approximate station)	Remarks

Item	Location (approximate station)	Remarks

PART THREE – APPENDICES

APPENDIX 1: Procedural Memorandum AD-18, Storm Emergency Operations

APPENDIX 2: Emergency Call List

APPENDIX 3: Rates of Increase in Water Surface Elevation

(page intentionally left blank)

Appendix 1: Procedural Memorandum AD-18, Storm Emergency Operations

(page intentionally left blank)

Appendix 2: Emergency Call List

Appendix 3: Anticipated Rates of Increase in Water Surface Elevation

(page intentionally left blank)

PUBLIC WORKS



SAN LUIS OBISPO COUNTY

DATE: **04-Dec-08**

LOCATION: **Arroyo Grande Creek**

JOB No: **452R208202**

& Los Berros Creek

JOB NAME: **Zone 1-1A Maintenances**

CALC BY: **Matt Reinhart**

Table 1: Arroyo Grande Creek Just Upstream of the 22nd Street Bridge

Design Storm	Rate of Increase in Water Surface (feet/hour)	Avg. Rainfall Intensity Over 24-Hr. Duration (inches/hour)
100-year	4.9	0.25
50-year	4.4	0.23
25-year	3.8	0.20
10-year	2.0	0.17
5-year	1.7	0.14
2-year	n.a.	0.11

Table 2: Los Berros Creek Just Upstream of the Valley Road Bridge

Design Storm	Rate of Increase in Water Surface (feet/hour)	Avg. Rainfall Intensity Over 24-Hr. Duration (inches/hour)
100-year	4.4	0.25
50-year	3.9	0.23
25-year	3.3	0.20
10-year	3.3	0.17
5-year	2.1	0.14
2-year	n.a.	0.11

Table 3: ANNUAL RAINFALL 14" TO 17"

Recurrence Interval (Years)	Duration							
	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	10 Hr
2	1.30	1.10	0.80	0.50	0.35	0.30	0.23	0.18
5	1.90	1.60	1.10	0.70	0.49	0.42	0.33	0.26
10	2.30	1.90	1.30	0.80	0.60	0.51	0.40	0.30
25	2.60	2.20	1.50	1.00	0.71	0.63	0.50	0.38
50	3.00	2.50	1.70	1.10	0.81	0.74	0.60	0.47
100	3.20	2.70	1.90	1.20	0.90	0.80	0.65	0.49

Note: The rates of increase in water surface elevation shown in Tables 1 & 2 were evaluated using the SCS Hydrograph Method. Intensities from the SLO County Dept. of Public Works Construction Dwg. H-4 that are shown in Table 3 above are intended to be used in the Rational Method and are only shown here for reference.

PUBLIC WORKS



SAN LUIS OBISPO COUNTY

WATER SURFACE LEVELS AT VARIOUS PRECIPITATION AMOUNTS OVER A 24-HOUR DURATION

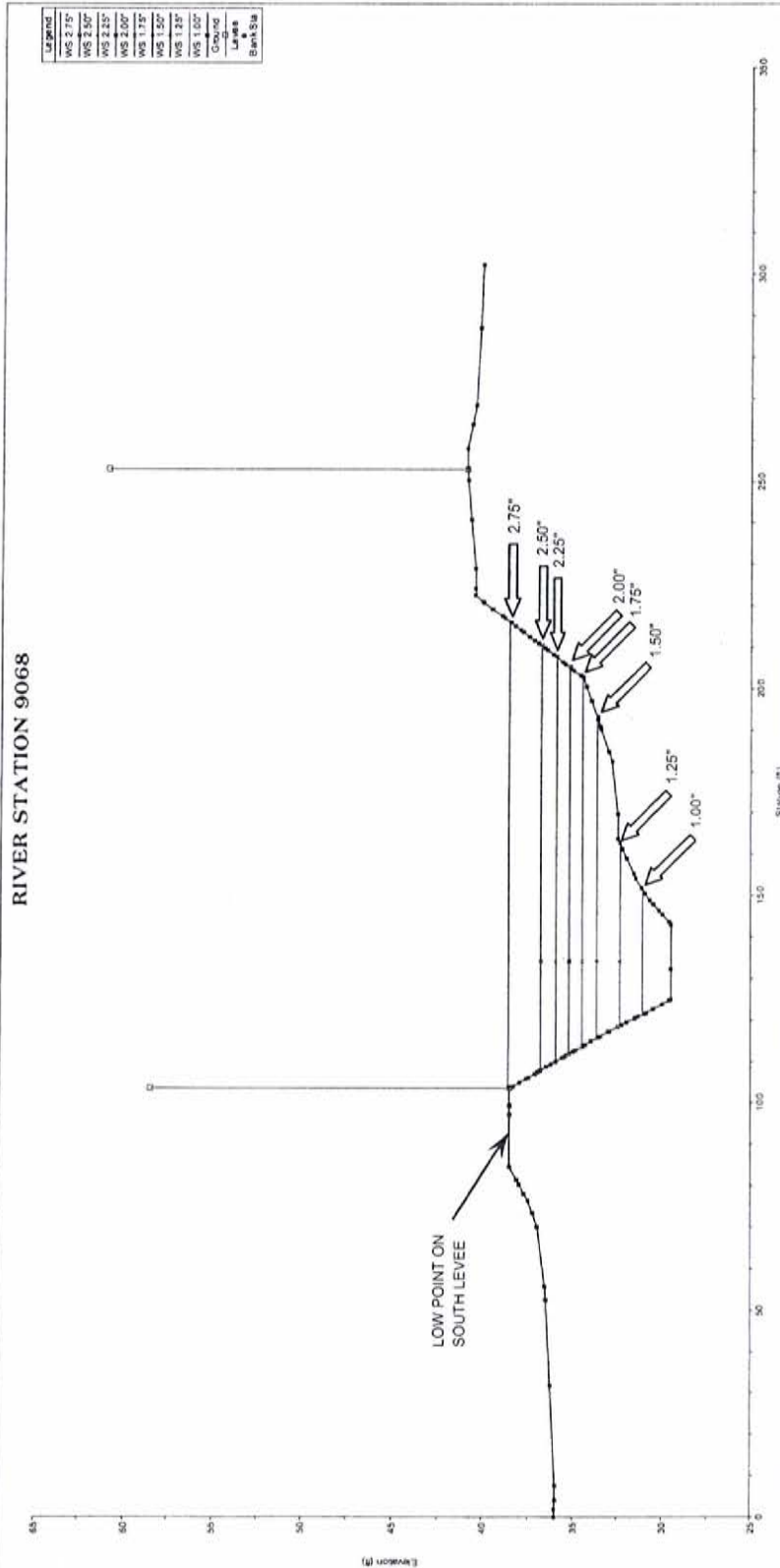


Exhibit 3N

IMPORTANT SAFETY INFORMATION ABOUT ARROYO GRANDE CREEK FLOODING & EVACUATION

INFORMACIÓN DE SEGURIDAD
IMPORTANTE SOBRE
INUNDACION Y EVACUACIÓN
DEL RIO DE ARROYO GRANDE



INFORMATION BOOKLET FROM
THE PUBLIC SAFETY AGENCIES
OF THE FIVE CITIES AREA AND
THE COUNTY OF SAN LUIS OBISPO

WHY DO I NEED TO BE PREPARED FOR CATASTROPHIC FLOODING FROM ARROYO GRANDE CREEK?

While many families are familiar with minor flooding issues, most people do not know what to do in case a levee breaks. Heavy rainfall and excessive runoff could lead to catastrophic flooding in areas adjacent to the levee.

People who live or work in the portions of Arroyo Grande Valley and Oceano need to be prepared in the unlikely event of a failure of the Arroyo Grande Levee. Officials in San Luis Obispo County have developed this booklet that will help direct you safely should you be threatened by a flood.

A catastrophic flood is a serious life-threatening event. In the event that heavy rains cause the levee to fail, deep, fast-moving water could begin flooding parts of Oceano almost immediately. This is why you and your family need to be prepared to evacuate immediately if you are in the flood zone. The map on the reverse side of this brochure indicates the approximate flood zone for a 100 year storm event.

IS THE ARROYO GRANDE CREEK LEVEE SAFE?

The levee is considered to be safe during smaller rainfall events. However, due to excessive buildup of soils, vegetation, and other materials within the creek, during a large storm event it is possible that the levee could fail and cause flooding of areas within one quarter mile of the creek as indicated by the map on the reverse side of this brochure.

WHAT IS THE PLAN?

In the event of a potential levee failure and/or flooding, emergency personnel will evaluate the situation to determine the best course of action. If the order to evacuate is given, the emergency sirens could sound and Public Works, law enforcement, and fire personnel will respond. Residents and visitors should go to the Oceano Community Building at 1425 19th Street. This is a temporary Area of Safe Refuge until the decision is made whether to allow re-entry or relocate evacuees to a designated shelter.

WHAT SHOULD I DO IF THE SIRENS SOUND AND I NEED TO EVACUATE?

If the sirens sound, immediately tune your radio to a local radio or television station for instructions. If the instructions are to evacuate, do so immediately. Do not expect that you will have more than 5 or 10 minutes to get to safety. Use the map inside this guide to plan your route NOW. Make sure your family knows where to go in the event of a catastrophic flood. This may mean seeking higher ground anywhere. For many residents in the flood zone it will be quicker and safer to evacuate a short distance on foot rather than by car. Take a prepared “Grab & Go” kit of essential supplies, if you have time. When in doubt, leave all possessions behind, because your life is more important.

DON'T BE SCARED! BE PREPARED! LEARN THE 6 KEYS TO SURVIVAL

1. Be familiar with evacuation routes, and know how to find higher ground.
2. Have a family plan that includes the name and telephone number of someone outside the area you can notify of your whereabouts, know school's plans for evacuation, and any special arrangements for the disabled, elderly, and very young.
3. If you are disabled or do not have transportation, make evacuation plans with neighbors now. Public transportation may not be available.
4. Prepare your own “Grab & Go” kit now. Include essential items such as a portable radio with extra batteries, drinking water, flashlight, pen and paper, medications, and a whistle.
5. Be prepared to self-evacuate immediately. Plan to evacuate to the house of a friend or relative who lives on higher ground outside the flood zone.
6. Use common sense and try to stay calm..
Stay safe and you can help others!

¿PORQUE NECESITO ESTAR PREPARADO PARA UNA INUNDACION CATASTRÓFICA CAUSADA POR EL RIO DE ARROYO GRANDE?

Mientras muchas familias estan familiarizadas con inundaciones de menor categoria, la mayoría de la gente no sabe qué hacer en caso de que un dique se rompa. Una extensa lluvia y grandes aguaseros podrían conducir a una inundacion catastrófica en áreas cercanas al dique.

Gente quién viva o trabaje en algunas areas de el Valle de Arroyo Grande y de Oceano necesitan estar preparados en el extraño y no tan probable caso de que el dique de Arroyo Grande no funcione como debido. Los funcionarios del condado de San Luis Obispo han desarrollado este libreto que les ayudará en dirigirlos a un lugar seguro si una inundación le amenaza.

Una inundación catastrófica es un serio acontecimiento peligroso para su vida. En caso que las lluvias pesadas causen que el dique falle, agua profunda y rápida podría comenzar a inundar partes de Oceano inmediatamente. Esta es la razón por la cual usted y su familia necesitan estar preparados para evacuar inmediatamente si usted está en la zona de inundación. El mapa detras de este libreto indica aproximadamente cual es la zona de inundacion para un evento de lluvia de 100 años.

¿QUE TAN SEGURO ES EL DIQUE DEL RIO DE ARROYO GRANDE?

El dique se considera ser seguro durante lluvias leves. Sin embargo, debido a la acumulación excesiva de tierra, de vegetación, y de otros materiales dentro del rio, durante una fuerte tormenta es posible que el dique pueda fallar y causar inundaciones en áreas a un cuarto de milla del rio tal como esta indicado en el mapa detras de este libreto.

¿CUAL ES EL PLAN?

En caso de una posibilidad de que falle el dique o que hubiera una inundacion, el personal de emergencia evaluará la situación para determinar la mejor línea de conducta. Si se da la orden a evacuacion, las sirenas de emergencia puede que sonen y el personal asignado del departamento de Public Works, la autoridad, y los bomberos responderan. Los residentes y el publico en general necitaran dirigirse a la siguiente direccion - Oceano Community Building localizada en el 1425 de la calle 19, en la ciudad de Oceano. Ésta localidad servira temporalmente como Área de refugio seguro hasta que una decisión sea tomada y se les permite regresar o tranfirir a los evacuados a otro lugar.

¿QUE NECESITO HACER SI ESCUCHO EL SONIDO DE LAS SIRENAS Y ES NECESSARIO EVACUAR?

Si las sirenas suenan, inmediatamente programe su radio o televisor a una estacion local para escuchar las instrucciones. Si las instrucciones son de evacuar, entonces evacuen inmediatamente. No espere tener mas de 5 a 10 minutos en encontrar un lugar seguro. Utilice el mapa dentro de esta guía AHORA para planear su ruta. Asegurese de que su familia sepa adónde ir en caso de una inundación catastrófica. Esto puede significar dirigirse a cualquier lugar más alto. Para muchos residentes en la zona de la inundación será más rápido y más seguro evacuar una distancia corta a pie en ves que en coche. Si usted tiene tiempo, llevese consigo su botiquin de primeros auxilios. Cuando en duda, deje todas las posesiones detrás, porque su vida es más importante.

¡NO SE ASUSTE! ¡ESTE PREPADO! APRENDA LAS 6 LLAVES A LA SUPERVIVENCIA

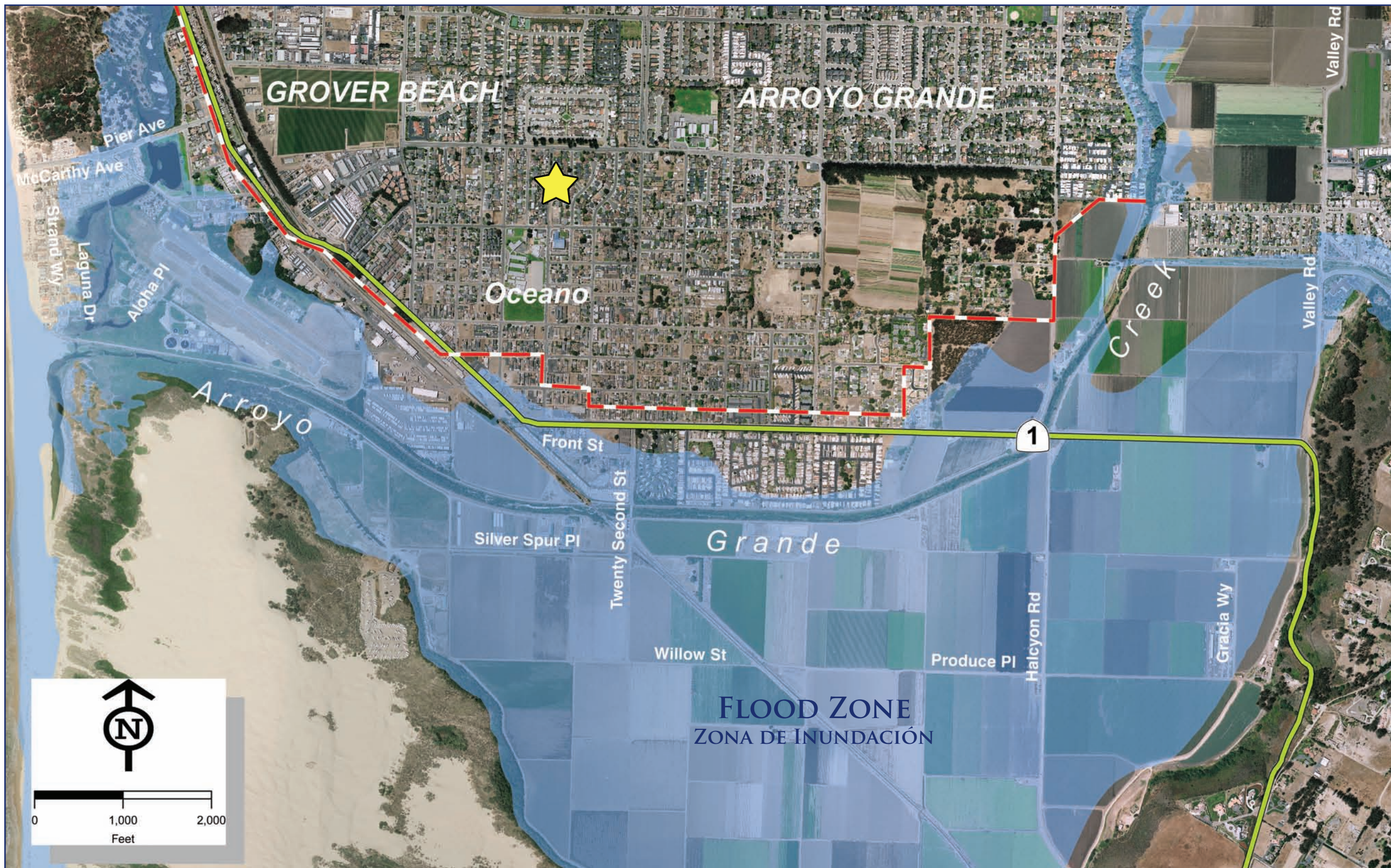
1. Esté familiarizado con las rutas de evacuación, y sepa encontrar un nivel de tierra más alto.
2. Tenga un plan dentro de su familia que incluya el nombre y el número de teléfono de alguien fuera del área que usted pueda notificar sobre su paradero, este familiarizado con el plan de evacuacion de la escuela, y cualquier arreglos especiales para las personas deshabilitadas, mayores, y personas muy jóvenes.
3. Si usted esta deshabilitado o no tiene transporte, haga los planes de evacuación inmediatamente con los vecinos. El transporte público puede ser que no este disponible.
4. Prepare su botiquin de primeros auxilios. Incluya los artículos esenciales tales como un radio portable con baterías adicionales, agua potable, linterna, pluma y papel, medicamentos, y un silbato.
5. Esté preparado para evacuar por si solo inmediatamente. Elabore un plan de evacuacion a la casa de un amigo o de un pariente que viva en un nivel de tierra más alto y que este fuera de la zona de la inundación.
6. Use su sentido común e intente permanecer tranquilo. *¡Mantenganse asalvo y podra ayudar a otros!*

OFFICIAL NOTICE FROM:

The County of San Luis Obispo,
Cities of Arroyo Grande,
Grover Beach, Pismo Beach and the
Oceano Community Services District

**SAFETY INFORMATION
FOR ARROYO CREEK LEVEE,
FLOODING AND EVACUATION
READ THIS BOOKLET NOW!**

**INFORMACIÓN DE SEGURIDAD
¡LEA ESTE LIBRETE AHORA!**



AREA OF SAFE REFUGE
ÁREA DE REFUGIO SEGURO

Oceano Community Center
1425 19th Street
Oceano, California

STUDY THIS MAP NOW!

1. Identify your home and workplace on this map.
2. If your home or workplace is located in the flood zone, plan your evacuation route to higher ground now.
3. Stay off Highway 1 in the flood zone.
4. Do not attempt to cross any flood waters.

IN CASE OF EMERGENCY

If the sirens sound, immediately tune to a local radio or television station and follow the instructions.

Do not go onto a roof to avoid the flood, you must leave the flood zone!

¡ESTUDIE ESTE MAPA AHORA!

1. Identifique su hogar y lugar de trabajo en este mapa.
2. Si su hogar o lugar de trabajo está situado en la zona de la inundación, planeé su ruta de la evacuación a un nivel de tierra más alta ahora.
3. Permanezca fuera de la carretera 1 en la zona de la inundación.
4. No intente cruzar ninguna zona de inundación.

EN CASO DE EMERGENCIA

Si las sirenas suenan, inmediatamente programe su radio o televisor a una estación local para escuchar las instrucciones.

No se dirija al techo de su casa para evitar la inundación, usted debe salir de la zona de la inundación!

ARROYO GRANDE CREEK - OCEANO, CA

FLOOD EVACUATION AREA

BASED ON FEMA FLOOD ZONE "A" DESIGNATION

Exhibit 3P

term community participation in defining future desired conditions for the creek and other watershed resources.

Summary of Findings

Preliminary assessment of the creek for steelhead habitat as well as assessment of the geomorphic and hydrologic conditions of the creek indicate that:

- There was agreement between the Arroyo Grande Creek Steering Committee and the Technical Advisory Committee that Arroyo Grande Creek should be recognized as an anadromous, natural production steelhead stream.
- In accordance with the accompanying Geomorphic and Hydrologic Assessment (Appendix B), the evolution of the creek corridor given human influences of increasing urbanization, Lopez Dam, and the flood control channel, along with the natural influences of underlying geology, is proceeding in such a way as to increase erosion along the banks of the creek, including head-cutting in the tributaries. Sediment is being deposited downstream, particularly in the Flood Control Channel.
- Water quality regarding nutrients is generally good. Sediment, as a water quality issue, needs to be addressed by stabilizing banks, increasing flood plain potential and continuing to work with landowners to install sediment reduction best management practices.
- Flood protection for the lower creek within the Flood Control Channel needs to be addressed through watershed-wide solutions coordinated among landowners, agencies and organizations.
- A comparison of historic versus present day available valley floor floodplain areas of Arroyo Grande Creek and its tributaries indicate that 15% of original floodplain area remains.

Limiting factors for Arroyo Grande Creek watershed include increasing sedimentation, decreasing spawning gravel quality and quantity, fish passage barriers, decreased water quantity, and increased water temperature due to a lack of canopy. The relatively good water quality in the watershed should be protected, as it is less expensive and more efficient to protect a water body's health than to remediate it once it has been impaired.

There is a considerable body of information regarding Arroyo Grande Creek. The culmination of several events are bringing to the forefront the need to address anew a coordinated management strategy for the watershed as the area continues to experience growth and land use changes.

Exhibit 3Q

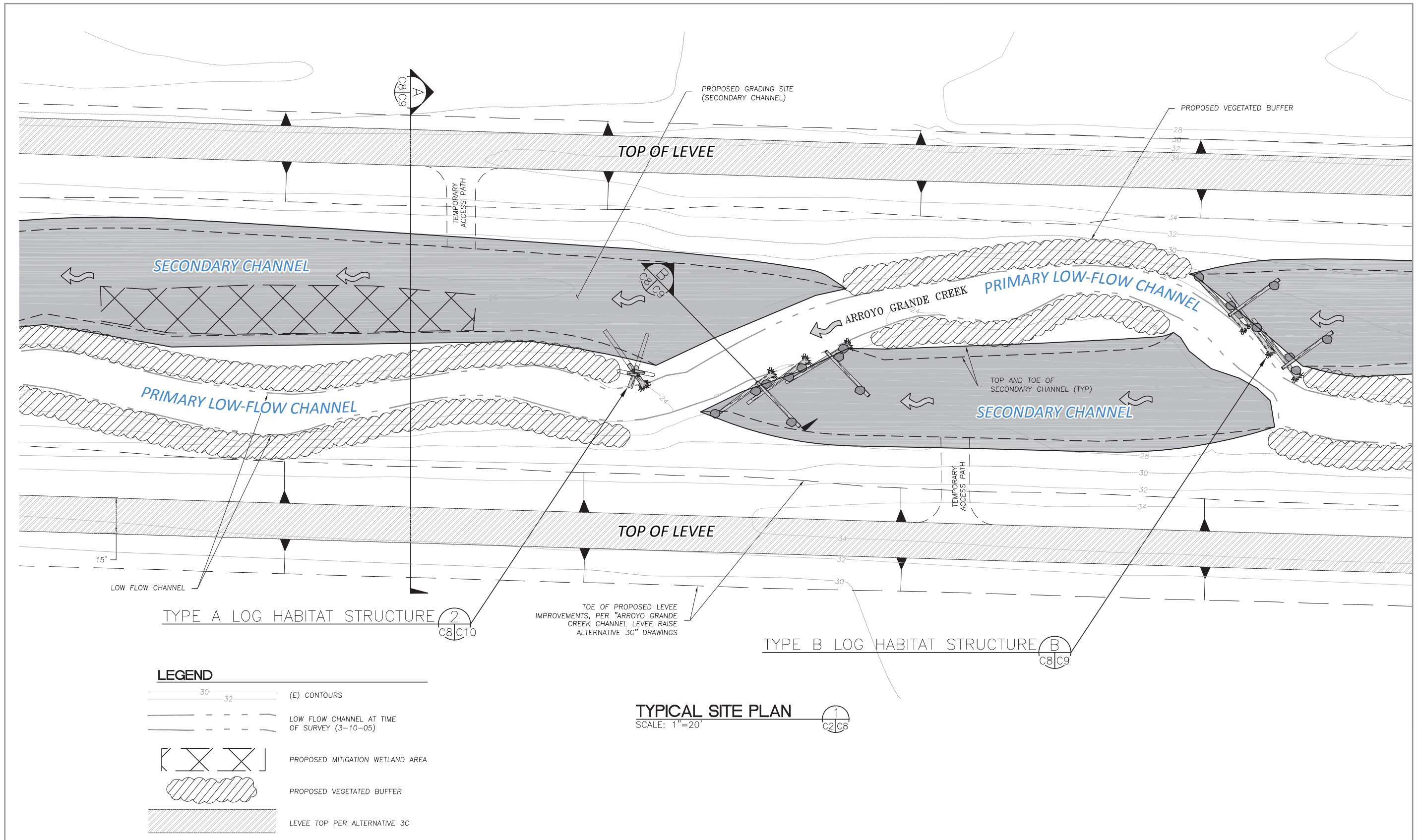


FIGURE 10
Conceptual sediment and vegetation management plans for the Arroyo Grande Creek Channel.

Exhibit 3R

Appendix B

Preliminary Engineering Design Plans

ARROYO GRANDE CREEK CHANNEL SEDIMENT AND VEGETATION MANAGEMENT PLAN CONCEPTUAL PLANS

PROJECT DESCRIPTION

THESE PLANS PROVIDE DETAILS FOR THE REMOVAL OF SEDIMENT FROM ARROYO GRANDE AND LOS BERROS CREEK CHANNELS IN THE COUNTY OF SAN LUIS OBISPO. CONSTRUCTION ACTIVITIES WILL CONSIST OF EXCAVATION AND DISPOSAL OF SEDIMENT FROM THE CHANNEL FLOODPLAINS AND INSTALLATION OF LOG HABITAT STRUCTURES.

GRADING SUMMARY

TOTAL CUT VOLUME =21,332 CY
TOTAL FILL VOLUME = 0 CY
NET CUT = 21,332 CY

THE ABOVE QUANTITIES ARE APPROXIMATE IN-PLACE VOLUMES CALCULATED AS THE DIFFERENCE BETWEEN EXISTING GROUND, AS MAPPED IN 2006, AND THE PROPOSED FINISH GRADE. EXISTING GROUND IS DEFINED BY THE TOPOGRAPHIC CONTOURS AND/OR SPOT ELEVATIONS ON THE PLAN. PROPOSED FINISH GRADE IS DEFINED AS THE DESIGN SURFACE ELEVATION OF EARTH TO BE CONSTRUCTED.

THE ABOVE QUANTITIES HAVE BEEN CALCULATED FOR PERMITTING PURPOSES ONLY AND HAVE NOT BEEN FACTORED TO INCLUDE ALLOWANCES FOR BULKING, CLEARING AND GRUBBING, SUBSIDENCE, SHRINKAGE, OVER EXCAVATION, AND RECOMPACTION, UNDERGROUND UTILITY AND SUBSTRUCTURE SPOILS AND CONSTRUCTION METHODS.

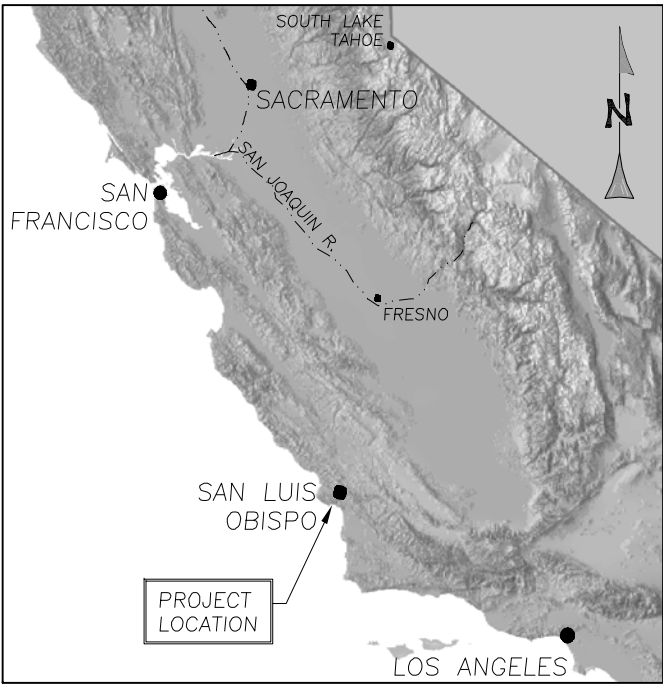
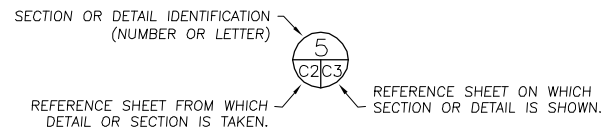
THE CONTRACTOR SHALL PERFORM AN INDEPENDENT EARTHWORK ESTIMATE FOR THE PURPOSE OF PREPARING BID PRICES FOR EARTHWORK. THE BID PRICE SHALL INCLUDE COSTS FOR ANY NECESSARY IMPORT AND PLACEMENT OF EARTH MATERIALS OR THE EXPORT AND PROPER DISPOSAL OF EXCESS EARTH MATERIALS.

PRIOR TO COMMENCEMENT OF CONSTRUCTION, CONTRACTOR SHALL PERFORM AN UPDATED CROSS SECTION SURVEY TO DETERMINE ACTUAL CONDITIONS.

GENERAL NOTES

- 1) PREPARED AT THE REQUEST OF:
SAN LUIS OBISPO COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT
- 2) AERIAL MAPPING OF THE PROJECT AREA WAS PERFORMED BY:
CENTRAL COAST AERIAL MAPPING, INC.
710 FIERO LN #24
SAN LUIS OBISPO, CALIFORNIA 93401
(805)543-4307
JOB# 2005-841
PHOTOGRAPHY DATE: 3/10/2005
- 3) ELEVATION DATUM: NAVD 88, BASED ON NGS BENCHMARK X 532, PID "FVO421", ELEVATION= 13.5'
- 4) HORIZONTAL DATUM: HORIZONTAL COORDINATES CONSTRAINED TO NGS MONUMENT HPGN CA 05 05, PID "FV2048", NAD83, CALIFORNIA STATE PLAN ZONE 5
- 5) APN'S: T.B.D.
- 6) ELEVATIONS AND DISTANCES SHOWN ARE IN FEET AND DECIMALS THEREOF. CONTOUR INTERVAL IS 2 FEET.
- 7) PROPERTY LINES ARE NOT SHOWN HEREON.
- 8) ALL CONSTRUCTION AND MATERIALS SHALL CONFORM TO THE CURRENT EDITION OF THE STATE OF CALIFORNIA STANDARD SPECIFICATIONS FOR CONSTRUCTION OF LOCAL STREETS AND ROADS (HEREAFTER REFERRED TO AS "STANDARD SPECIFICATIONS", AND SHALL BE SUBJECT TO APPROVAL OF THE OWNER.
- 9) THE COUNTY PUBLIC WORKS DEPARTMENT SHALL BE NOTIFIED AT LEAST 48 HOURS PRIOR TO CONSTRUCTION. A QUALIFIED CIVIL ENGINEER WITH EXPERIENCE IN THE INSTALLATION OF FEATURES OF THE TYPE SHOWN ON THESE PLANS, SHALL PROVIDE INSPECTION SERVICES DURING THE CONSTRUCTION PROCESS.
- 10) CONSTRUCTION CONTRACTOR AGREES THAT IN ACCORDANCE WITH GENERALLY ACCEPTED CONSTRUCTION PRACTICES, CONSTRUCTION CONTRACTOR WILL BE REQUIRED TO ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL BE MADE TO APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND CONSTRUCTION CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD DESIGN PROFESSIONAL HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTION LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF DESIGN PROFESSIONAL. NEITHER THE PROFESSIONAL ACTIVITIES OF CONSULTANT NOR THE PRESENCE OF CONSULTANT OR HIS OR HER EMPLOYEES OR SUB-CONSULTANTS AT A CONSTRUCTION SITE SHALL RELIEVE THE CONTRACTOR AND ITS SUBCONTRACTORS OF THEIR RESPONSIBILITIES INCLUDING, NOT LIMITED TO, CONSTRUCTION MEANS, METHODS, SEQUENCE, TECHNIQUES OR PROCEDURES NECESSARY FOR PERFORMING, SUPERINTENDING OR COORDINATING ALL PORTIONS OF THE WORK OF CONSTRUCTION IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND APPLICABLE HEALTH OR SAFETY REQUIREMENTS OF ANY REGULATORY AGENCY OR OF STATE LAW.

SECTION AND DETAIL CONVENTION



REGIONAL MAP
N.T.S.



VICINITY MAP
N.T.S.

SHEET INDEX

C1	COVER SHEET	C6	SITE PLAN 4 OF 5
C2	PROJECT AREA OVERVIEW	C7	SITE PLAN 5 OF 5
C3	SITE PLAN 1 OF 5	C8	TYPICAL SITE PLAN
C4	SITE PLAN 2 OF 5	C9	TYPICAL SECTIONS
C5	SITE PLAN 3 OF 5	C10	DETAILS

GENERAL NOTES CONT'D

- 11) EXISTING UNDERGROUND UTILITY LOCATIONS:

LOCATIONS SHOWN ARE COMPILED FROM INFORMATION SUPPLIED BY THE APPROPRIATE UTILITY AGENCIES OR FROM FIELD MEASUREMENTS TO ABOVE GROUND FEATURES READILY VISIBLE AT THE TIME OF SURVEY. LOCATIONS SHOWN ARE APPROXIMATE. THE CONTRACTOR IS CAUTIONED THAT ONLY ACTUAL EXCAVATION WILL REVEAL THE DIMENSIONS, SIZES, MATERIALS, LOCATIONS, AND DEPTH OF UNDERGROUND UTILITIES.

THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE LOCATION AND/OR PROTECTION OF ALL EXISTING AND PROPOSED PIPING, UTILITIES, TRAFFIC SIGNAL EQUIPMENT (BOTH ABOVE GROUND AND BELOW GROUND), STRUCTURES, AND ALL OTHER EXISTING IMPROVEMENTS THROUGHOUT CONSTRUCTION.

PRIOR TO COMMENCING FABRICATION OR CONSTRUCTION, CONTRACTOR SHALL DISCOVER OR VERIFY THE ACTUAL DIMENSIONS, SIZES, MATERIALS, LOCATIONS, AND ELEVATIONS OF ALL EXISTING UTILITIES AND POTHOLE THOSE AREAS WHERE POTENTIAL CONFLICTS ARE LIKELY OR DATA IS OTHERWISE INCOMPLETE.

CONTRACTOR SHALL TAKE APPROPRIATE MEASURES TO PROTECT EXISTING UTILITIES DURING CONSTRUCTION OPERATIONS, AND SHALL BE SOLELY RESPONSIBLE FOR THE COST OF REPAIR/REPLACEMENT OF ANY EXISTING UTILITIES DAMAGED DURING CONSTRUCTION. CONTRACTOR TO CALL UNDERGROUND SERVICE ALERT (1-800-642-2444) TO LOCATE ALL UNDERGROUND UTILITY LINES PRIOR TO COMMENCING CONSTRUCTION.

UPON LEARNING OF THE EXISTENCE AND/OR LOCATIONS OF ANY UNDERGROUND FACILITIES NOT SHOWN OR SHOWN INACCURATELY ON THE PLANS OR NOT PROPERLY MARKED BY THE UTILITY OWNER, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE UTILITY OWNER AND THE CITY BY TELEPHONE AND IN WRITING.

UTILITY RELOCATIONS REQUIRED FOR THE CONSTRUCTION OF THE PROJECT FACILITIES WILL BE PERFORMED BY THE UTILITY COMPANY, UNLESS OTHERWISE NOTED.

PRIOR TO BEGINNING WORK, THE CONTRACTOR SHALL CONTACT ALL UTILITIES COMPANIES WITH REGARD TO WORKING OVER, UNDER, OR AROUND EXISTING FACILITIES AND TO OBTAIN INFORMATION REGARDING RESTRICTIONS THAT ARE REQUIRED TO PREVENT DAMAGE TO THE FACILITIES.

- 12) SHOULD THE CONTRACTOR DISCOVER ANY DISCREPANCIES BETWEEN THE CONDITIONS EXISTING IN THE FIELD AND THE INFORMATION SHOWN ON THESE DRAWINGS, HE SHALL NOTIFY THE ENGINEER PRIOR TO PROCEEDING WITH CONSTRUCTION.

- 13) THE CONTRACTOR SHALL BE RESPONSIBLE FOR DESIGN, PERMITTING, INSTALLATION, AND MAINTENANCE OF ANY AND ALL TRAFFIC CONTROL MEASURES DEEMED NECESSARY.

- 14) THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE GENERAL SAFETY DURING CONSTRUCTION. ALL WORK SHALL CONFORM TO PERTINENT SAFETY REGULATIONS AND CODES. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR FURNISHING, INSTALLING, AND MAINTAINING ALL WARNING SIGNS AND DEVICES NECESSARY TO SAFEGUARD THE GENERAL PUBLIC AND THE WORK, AND PROVIDE FOR THE PROPER AND SAFE ROUTING OF VEHICULAR AND PEDESTRIAN TRAFFIC DURING THE PERFORMANCE OF THE WORK. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR COMPLIANCE WITH ALL APPLICABLE PROVISIONS OF OSHA IN THE CONSTRUCTION PRACTICES FOR ALL EMPLOYEES DIRECTLY ENGAGED IN THE CONSTRUCTION OF THIS PROJECT.

- 15) THE CONTRACTOR SHALL PURSUE WORK IN A CONTINUOUS AND DILIGENT MANNER TO ENSURE A TIMELY COMPLETION OF THE PROJECT.

- 16) ALL CONSTRUCTION SHALL BE CLOSELY COORDINATED WITH THE ENGINEER SO THAT THE QUALITY OF WORK CAN BE CHECKED FOR APPROVAL.

- 17) THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE SITE IN A NEAT AND ORDERLY MANNER THROUGHOUT THE CONSTRUCTION PROCESS. ALL MATERIALS SHALL BE STORED WITHIN APPROVED CONSTRUCTION AREAS.

- 18) THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING AT HIS EXPENSE, ALL PERMITS AS REQUIRED BY THE LOCAL AGENCIES, INCLUDING BUT NOT LIMITED TO; ENCROACHMENT, GRADING AND LANE CLOSURES NOT PREVIOUSLY OBTAINED BY THE OWNER. THE CONTRACTOR SHALL PROVIDE ALL MATERIALS, LABOR AND EQUIPMENT REQUIRED TO COMPLY WITH ALL APPLICABLE PERMIT CONDITIONS AND REQUIREMENTS.

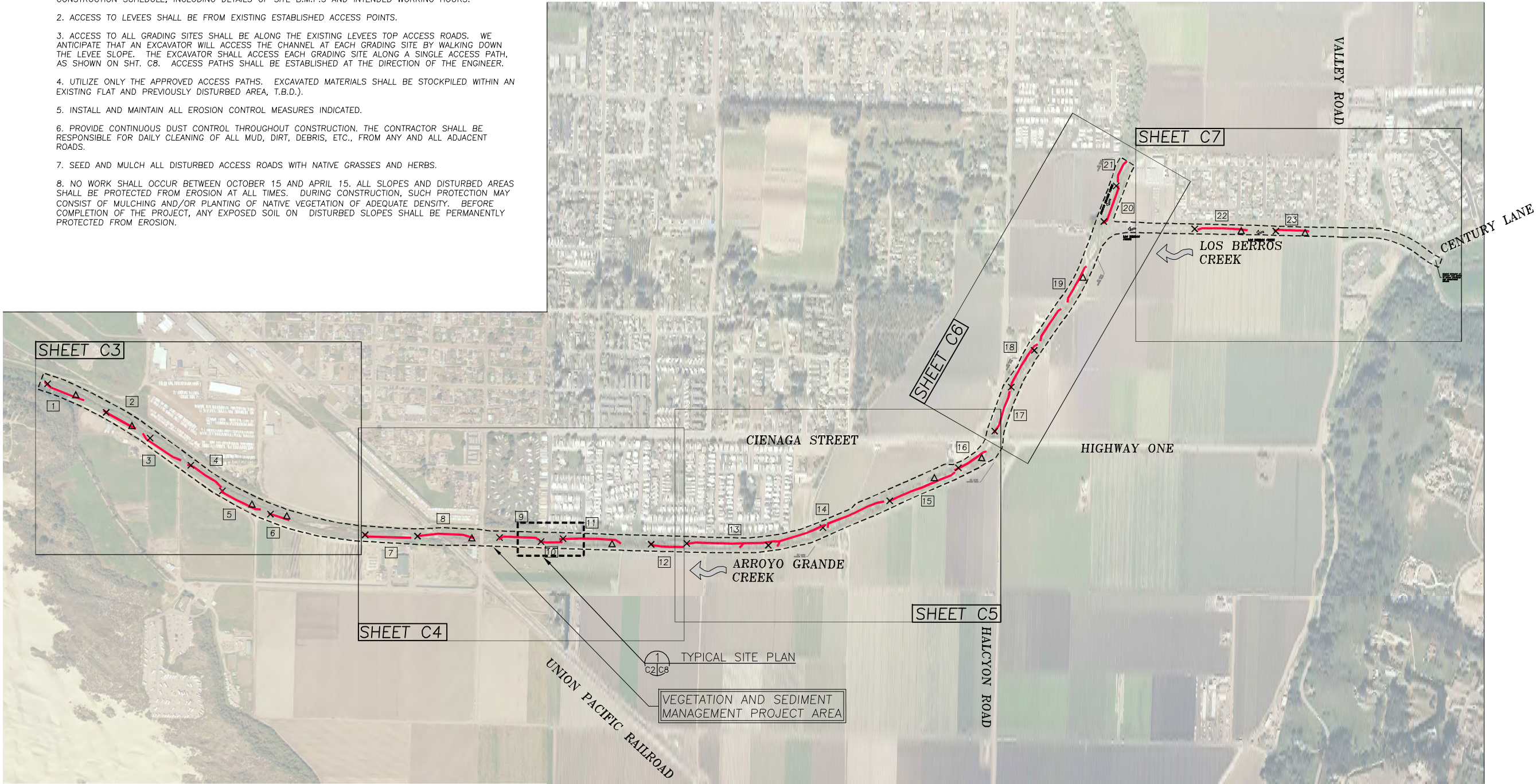
- 19) CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CONSTRUCTION STAKING AND LAYOUT, UNLESS OTHERWISE SPECIFIED IN THE PLANS.

- 20) NO CONSTRUCTION SHALL BE STARTED WITHOUT PLANS APPROVED BY THE COUNTY DEPARTMENT OF PUBLIC WORKS. THE DEPARTMENT OF PUBLIC WORKS SHALL BE NOTIFIED AT LEAST 48 HOURS PRIOR TO THE START OF CONSTRUCTION AND OF THE TIME AND LOCATION OF THE PRE-CONSTRUCTION CONFERENCE. ANY CONSTRUCTION PERFORMED WITHOUT PRIOR NOTIFICATION TO THE DEPARTMENT OF PUBLIC WORKS WILL BE REJECTED AND WILL BE AT THE CONTRACTOR'S RISK.

- 21) THE CONTRACTOR SHALL NOT BEGIN ANY CONSTRUCTION WORK UNTIL THE PROJECT SCHEDULE AND WORK PLAN IS APPROVED BY THE ENGINEER.

EROSION CONTROL AND ACCESS NOTES

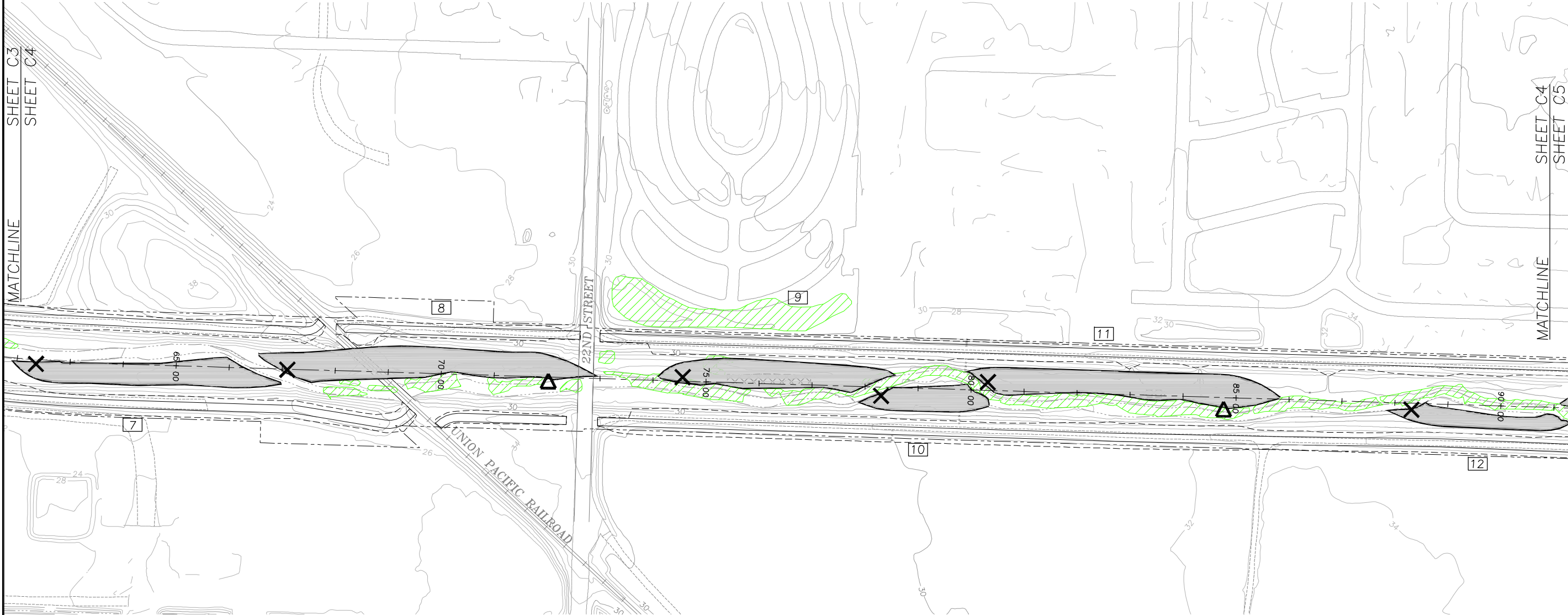
1. PRIOR TO COMMENCEMENT OF WORK, CONTRACTOR SHALL PROVIDE THE ENGINEER WITH A DETAILED CONSTRUCTION SCHEDULE, INCLUDING DETAILS OF SITE B.M.P.S AND INTENDED WORKING HOURS.
2. ACCESS TO LEVEES SHALL BE FROM EXISTING ESTABLISHED ACCESS POINTS.
3. ACCESS TO ALL GRADING SITES SHALL BE ALONG THE EXISTING LEVEES TOP ACCESS ROADS. WE ANTICIPATE THAT AN EXCAVATOR WILL ACCESS THE CHANNEL AT EACH GRADING SITE BY WALKING DOWN THE LEVEE SLOPE. THE EXCAVATOR SHALL ACCESS EACH GRADING SITE ALONG A SINGLE ACCESS PATH, AS SHOWN ON SHT. C8. ACCESS PATHS SHALL BE ESTABLISHED AT THE DIRECTION OF THE ENGINEER.
4. UTILIZE ONLY THE APPROVED ACCESS PATHS. EXCAVATED MATERIALS SHALL BE STOCKPILED WITHIN AN EXISTING FLAT AND PREVIOUSLY DISTURBED AREA, T.B.D.).
5. INSTALL AND MAINTAIN ALL EROSION CONTROL MEASURES INDICATED.
6. PROVIDE CONTINUOUS DUST CONTROL THROUGHOUT CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DAILY CLEANING OF ALL MUD, DIRT, DEBRIS, ETC., FROM ANY AND ALL ADJACENT ROADS.
7. SEED AND MULCH ALL DISTURBED ACCESS ROADS WITH NATIVE GRASSES AND HERBS.
8. NO WORK SHALL OCCUR BETWEEN OCTOBER 15 AND APRIL 15. ALL SLOPES AND DISTURBED AREAS SHALL BE PROTECTED FROM EROSION AT ALL TIMES. DURING CONSTRUCTION, SUCH PROTECTION MAY CONSIST OF MULCHING AND/OR PLANTING OF NATIVE VEGETATION OF ADEQUATE DENSITY. BEFORE COMPLETION OF THE PROJECT, ANY EXPOSED SOIL ON DISTURBED SLOPES SHALL BE PERMANENTLY PROTECTED FROM EROSION.



PROJECT AREA OVERVIEW
SCALE: 1"=500'

LEGEND

- △ TYPE "A" LOG HABITAT STRUCTURE (11 TOTAL)
- × TYPE "B" LOG HABITAT STRUCTURE (24 TOTAL)
- 9 GRADING SITE IDENTIFICATION NUMBER
- PROPOSED GRADING SITE (SECONDARY CHANNEL)

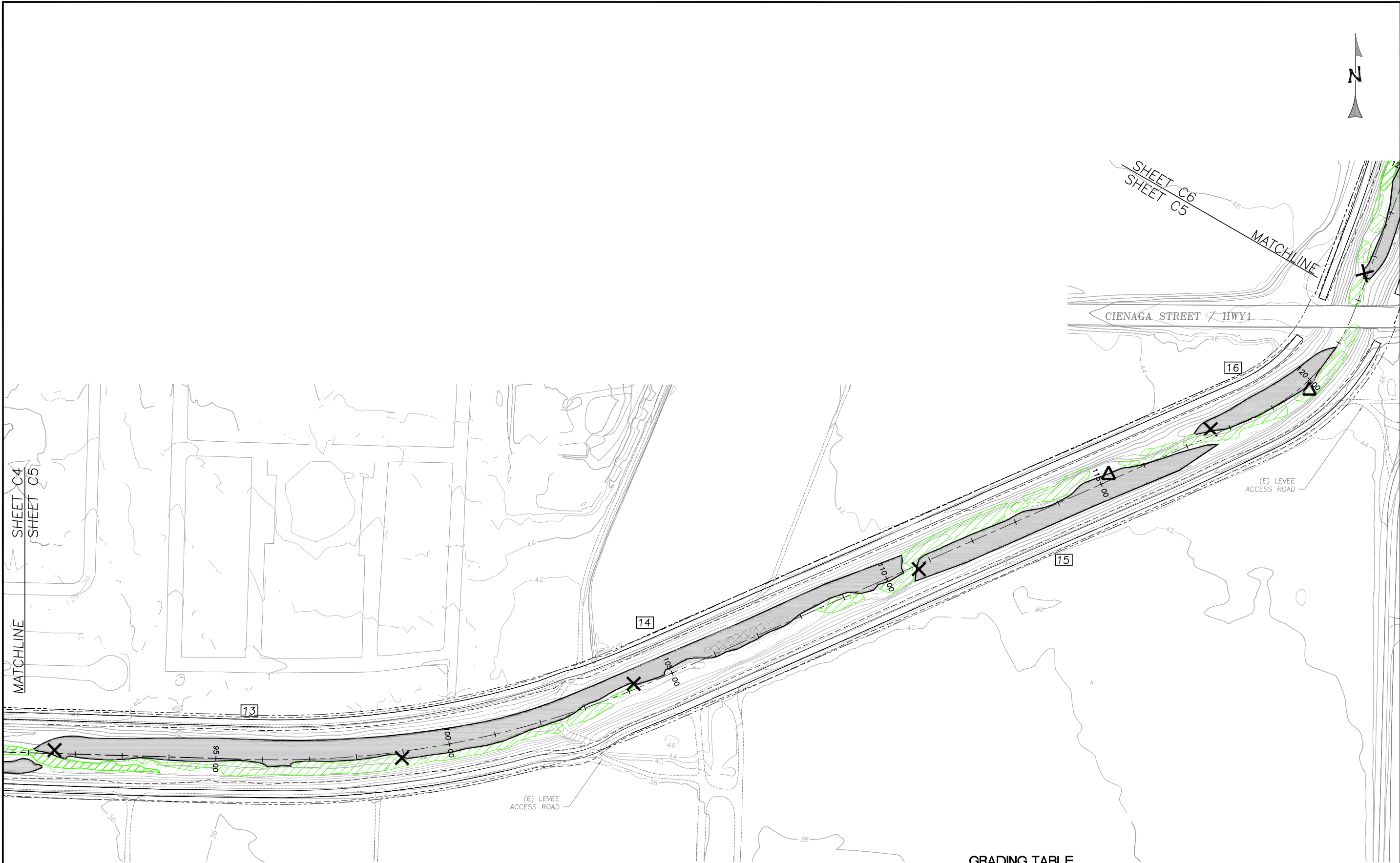


SITE PLAN
 SCALE: 1"=100'

GRADING TABLE

SITE	GRADING SITE FINISHED GRADE EL.		EXCAVATION VOLUME (CY)	LENGTH APPROX (FT)	AVG. DEPTH (FT)
7	21	TO 22	193	450	0.3
8	22	TO 24	1,121	560	1.1
9	24.5	TO 25.8	738	400	1.0
10	25.8	TO 26.1	498	210	1.4
11	26.2	TO 28.5	1,262	530	1.3
12	29	TO 29.2	243	300	0.6





SITE PLAN
SCALE: 1"=100'

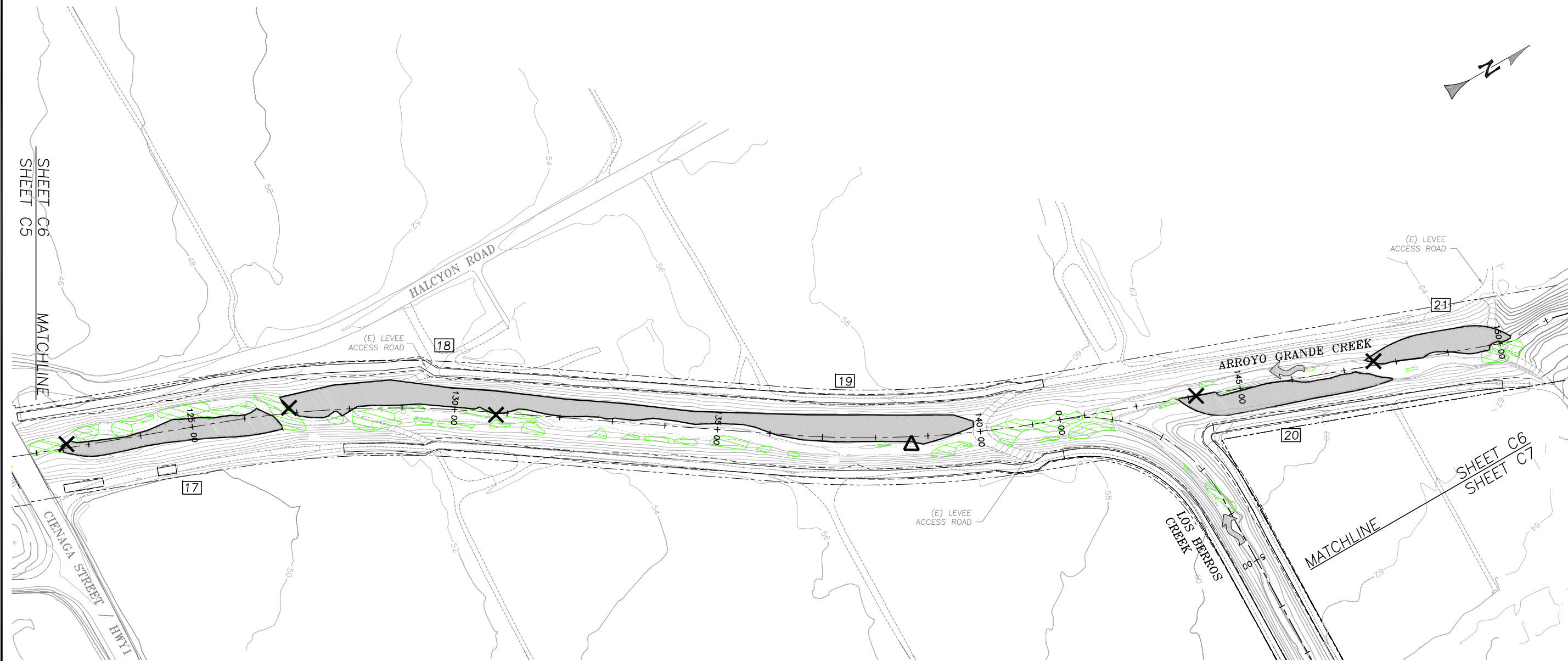
GRADING TABLE

SITE	GRADING SITE FINISHED GRADE EL.	EXCAVATION VOLUME (CY)	LENGTH APPROX (FT)	AVG. DEPTH (FT)
13	29.5 TO 31.5	2,700	830	1.8
14	31.5 TO 35	3,110	1,030	2.0
15	35.5 TO 37	1,309	660	1.2
16	37.5 TO 38.5	516	310	1.1

DESIGNED BY: B.M.S.
DRAWN BY: B.M.S.
CHECKED BY: M.W.W.
DATE: 9/21/09
JOB NO.: 08-707

BAR IS ONE INCH ON
ORIGINAL DRAWING.
ADJUST SCALES FOR
REDUCED PLOTS

C5
5
OF
10

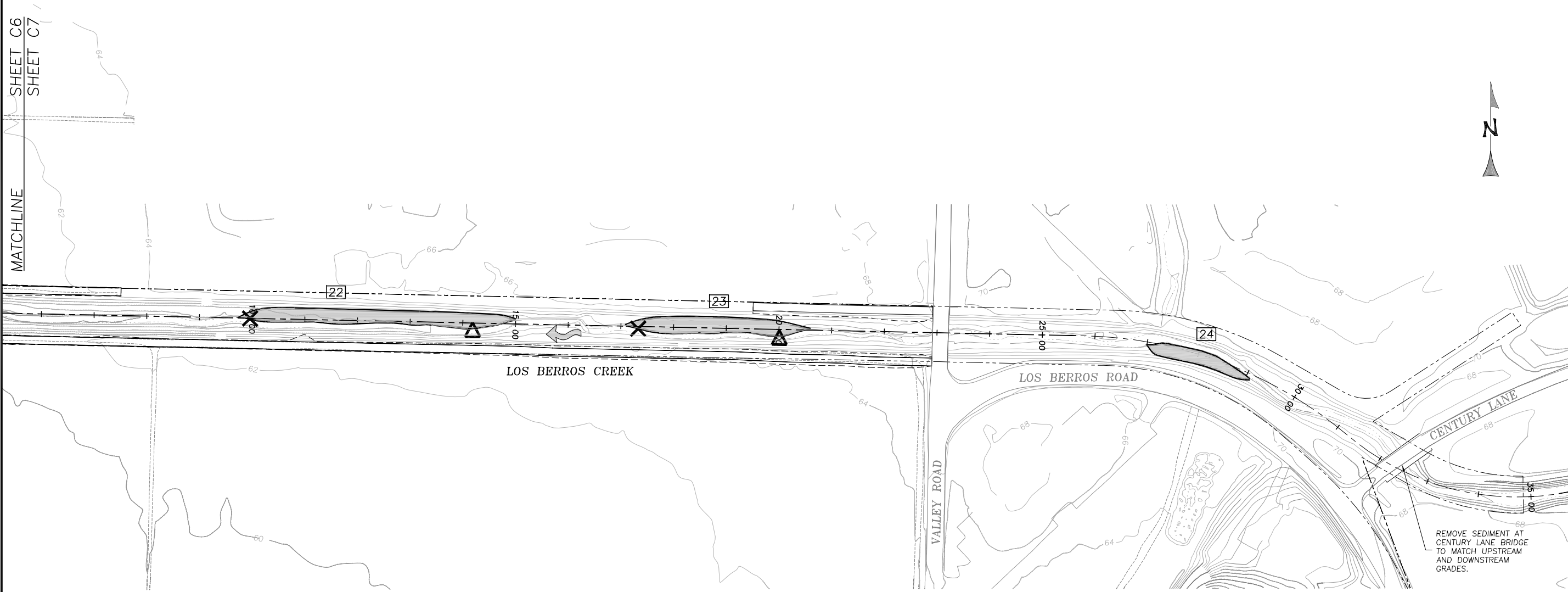


SITE PLAN
SCALE: 1"=100'

GRADING TABLE

SITE	GRADING SITE FINISHED GRADE EL.	EXCAVATION VOLUME (CY)	LENGTH APPROX (FT)	AVG. DEPTH (FT)
17	38.5 TO 40.5	605	400	1.2
18	40.5 TO 44	615	490	0.8
19	44 TO 46	504	800	0.5
20	47 TO 48	767	350	1.3
21	48.5 TO 49	532	250	1.3

MATCHLINE
SHEET C6
SHEET C7



SITE PLAN
SCALE: 1"=100'

GRADING TABLE

SITE	GRADING SITE FINISHED GRADE EL.	EXCAVATION VOLUME (CY)	LENGTH APPROX (FT)	AVG. DEPTH (FT)
22	52.5 TO 54.5	825	480	1.5
23	55.5 TO 56	592	320	1.7
24	60.2 TO 60.6	106	140	0.7

DESIGNED BY: B.M.S.
DRAWN BY: B.M.S.
CHECKED BY: M.W.W.
DATE: 9/21/09
JOB NO.: 08-707

BAR IS ONE INCH ON ORIGINAL DRAWING. ADJUST SCALES FOR REDUCED PLOTS

0 1"

